METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

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Published Monthly by

FINISHING PUBLICATIONS, INC.

Serving the electroplating and industrial coating fields with specialized monthlies and guidebooks since 1903. Companion publication, ORGANIC FINISHING.

Editorial, circulation and publishing office at 11 West 42nd Street, New York 36, N. Y. Telephone PEnnsylvania 6-0226. District advertising sales offices at 19 Elmwood Place, Hornell, New York, telephone Hornell 943, and 742 S. Hill Street, Los Angeles 14, California, telephone MAdison 6-5421.

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CCA — Controlled Circulation Audit

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Subscription Information

United States and Canada $4.00 per year, other countries $8.00. Single copies 45c in U. S. and Canada, other countries 85c. Annual subscription to both METAL FINISHING and ORGANIC FINISHING, including annual GUIDEBOOKS, $5.00 U.S. and Canada.

GUIDEBOOK-DIRECTORY 20th edition 1951 current, 588 pages 5¼ x 7⅞ $2.50. Please remit by check or money order; cash should be registered. All correspondence should be directed to **11 West 42nd Street, New York 36, N. Y.** Publisher reserves the right to reject any subscription which does not conform to his standards of buying power coverage. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us your change of address please be sure to send us your old address as well as the new one.

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COMING SOON

A discussion of the factors to be considered in using clear lacquers as protectives over plated surfaces.

Methods for the chemical analysis of chromium plating baths containing fluorides and fluosilicates.

A review of the methods and applications for metallic coatings deposited from gaseous media.

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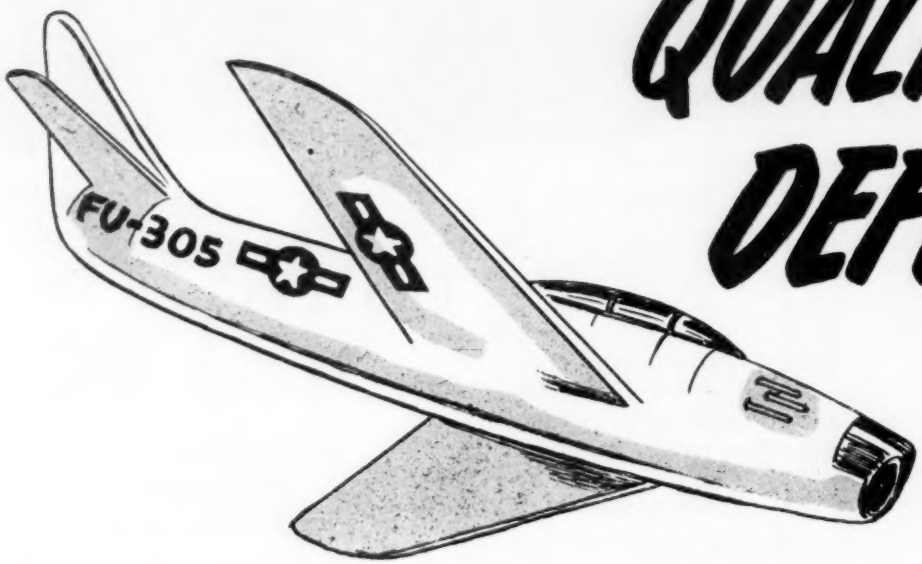

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The WASHINGTON OBSERVER

George W. Grupp

News and Views from The Nation's Capitol

• The Electroplating Industry Advisory Committee has asked the N.P.A. that "M-80 be revised for greater liberality, or be clarified to place the responsibility for conformity with the order's end-use restrictions upon the contractor ordering the plating service"; that "Schedule I of M-80 be revised to permit re-plating services"; that "a study be made of requirements of the electroplating jobbers industry"; and that "on applications for certificates of necessity, DPA should consider the need of plants to expand or acquire machinery to handle processes required for defense works...of splitting large contracts among a number of small electroplating jobbers".

• The electroplating industry, the NPA believes, can maintain itself on 15% of its base period use of nickel anodes. However, electroplating jobbers are already complaining to the NPA that they are not obtaining the needed quantities of nickel for permitted operations under Order M-80.

• In amending Consumer Durable Goods Order M-47B, hollow silverware and plateware was placed in Group IV because of lower allotments.

• The trend of large manufacturers is to do their own electroplating, due in part to some military contracts requiring that the entire product be completely produced in one plant. This trend has slowed up the operations of electroplating jobbers from 30 to 50%.

• N.P.A. recently amended Order M-25 to permit an increased weight of tin coating on cans used for packing certain foodstuffs.

• The Census Bureau reports that the number of estatlishments exclusively engaged in plating and polishing increased from 547 in 1937 to 1,802 in 1947; that the number of hot-dip galvanizing shops increased from 64 in 1937 to 125 in 1947. The value of products shipped from plating and polishing shops increased from $26,686,000 in 1937 to $176,492,000 in 1947.

• The N.P.A. has been asked to get Congress to suspend the duty on imported lead. A bill has also been introduced in Congress which provides for temporary free importation of zinc.

• Increased copper production is expected in Chile, Peru and Rhodesia during 1952.

• During 1951 the Armed Forces received $16,000,000,000 worth of equipment, supplies, and construction. Deliveries are presently at rate of $2,000,000,000 a month of which $1,300,000,000 is for such hard goods as artillery, aircraft, tanks and ships.

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Saves in Nickel

Saves in Copper

Saves in Time

Saves in Nickel...

because with it, plating of chromium on properly pre-finished steel and die-castings directly, without any intermediate buffing operation, is practicable.

Saves in Copper...

because of its exceptional brightness, no subsequent buffing or coloring of properly pre-finished work is necessary. With the standard sodium formula, 30 to 35% less copper cyanide is needed in make up than with other high speed processes. With potassium it is 10 to 15% less. There's less dragout loss; less salt tie-up.

Saves on Tank Time...

because the high current density, with its high speed plating, results in brilliant copper deposits of required thickness in a shorter period.

Saves in Buffing...

because of the bright, soft, easily-flowed copper deposit. Thus, where buffing or polishing is more economical than pre-finishing, considerable time is saved. Production per man is increased.

Lea Copper-Glo is proving a boon to the defense project. Let it help you in your problem of saving nickel, saving copper and saving time.

Lea Copper-Glo is used in conjunction with the Ronal Bright Copper Process, a development of Ronal Chemicals, Brooklyn, N. Y.

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions

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METAL FINISHING

UME 50 • NUMBER 3 • MARCH 1952

Will-O-The-Wisp

The field of corrosion testing must be exasperating, and fascinating, if one studies the fluctuation in importance attached to the various methods for evaluating the quality of finishes and coatings.

In the earliest days of finish testing the most natural thing seemed to be to simply expose the finished test pieces outdoors and let nature take its course. It didn't take long to find out that Mother Nature was a capricious individual, however; results varied all over the lot!

The next phase of atmospheric corrosion testing involved standardization of specimens, exposure angles, holding methods, quantitative ratings, and test locations (rural, marine, and industrial). Still the discrepancies continued, until technicians felt that the only way a true evaluation could be made was under carefully controlled laboratory conditions. Thus was born the salt-spray era and all its ramifications. Although this test undoubtedly has a definite place in the overall scheme of finish evaluation, it has the annoying disadvantage of giving results which may bear little, if any, relation to results obtained in outdoor service tests!

Today we are again drifting away from the salt spray test as a reliable indicator of the probable life of a finish, and once again returning to outdoor exposure in various localities assumed to present different, yet typical, corrosive environments. While this is a time-consuming approach, it would seem to be the only one that could be relied upon. Some recent work on plated zinc, aluminum, and magnesium die-castings tends to discredit the accuracy of even this approach, however. For instance, it was found that almost identical results were obtained on identical sets of specimens (with various plating thicknesses) exposed to the atmospheres of Grand Rapids and Miami, while much different results were obtained on identical specimens exposed in so-called "industrial" exposure sites. Frankly, it is hard to imagine a test site more "rural" than one near Grand Rapids, nor one more "marine" than Miami, yet similar results were obtained in both places!

It looks like we're right back where we started, with results still all over the lot! The only thing consistent about corrosion testing is its inconsistency!

Where does all this leave the plating industry?

It means that until a more dependable method of evaluation is developed, we'll have to keep putting on a little "extra" metal to insure good service in every type of location. Practical research to determine the *minimum* amount of plating required to insure, with *NO* failures, adequate service life under all normal exposure conditions for a specified length of time looks like the common-sense approach to this vexing problem.

W. A. Raymond

Editor

Barrel Finishing at Eureka-Williams

By Joe Reinholz, *Plating Foreman, Eureka-Williams Corp., Bloomington, Ill.*

NUMEROUS components fabricated by or purchased for use in vacuum cleaners and oil burners manufactured by *Eureka-Williams Corp.* at its Bloomington, Ill. plant are now being given barrel processing in a new installation of equipment, with marked economies as compared with prior setups. Of special importance is the saving in wheel polishing and buffing formerly done by hand and requiring much labor. Less than one-quarter of the wheels used before remain in use, and they are not employed to capacity. Corresponding savings in labor are important and extend also to deburring and descaling operations not needing wheel work before.

To attain the savings here described, the corporation installed three two-compartment tumbling barrels of 36-in. dia. having synthetic rubber linings for wet operations, and one barrel for dry tumbling in sawdust to improve the luster on parts that are first given a bright honing treatment in wet barrels. Also used is supplemental equipment for cleaning, dipping, drying and for handling the limestone chips employed, as shown in accompanying illustrations.

Comparatively little labor is required in using the new equipment, as the parts are all handled in bulk, and then only in loading and unloading the barrels. In general, the schedules have been so worked out that the barrels run at night without attendance, and one man easily does the barrel loading and unloading besides performing such supplementary operations as are required.

As shown in Figure 1, in which the three wet barrels appear, chips are handled in pans by an electric hoist. Very little manual lifting is necessary, and that only in small lots light in weight. In general, chips remain in the barrels for more than one run and, when dumped on a screen to separate from parts processed, usually are returned to the same compartment for the next run. Parts are handled in tote boxes or in woven wire buckets that are light and easily moved.

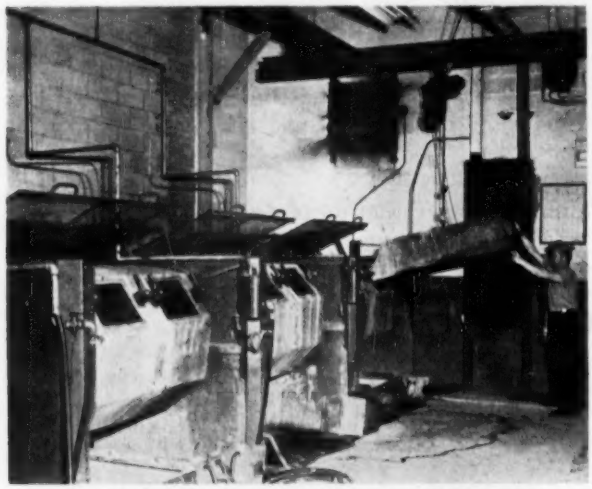


Figure 1. Loading limestone chips into one of the three barrels in the wet tumbling line recently installed in the Eureka-Williams plant. An electric trolley hoist saves manual handling.

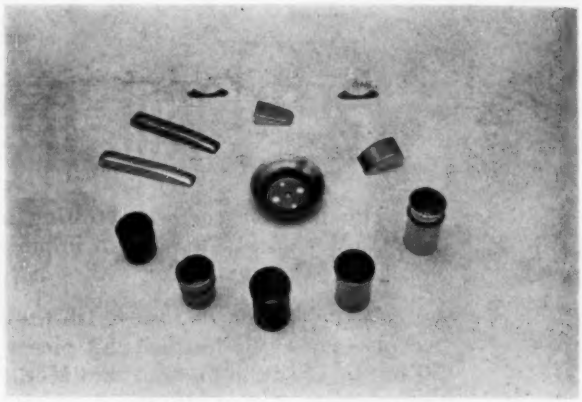


Figure 2. All of these parts for vacuum cleaners or oil burners undergo wet tumbling operations for scale removal, brighthoning or burr removal. Tubular parts are shown as they appear both before and after treatment.

In Figure 2 are shown a group of parts typical of those processed. Eight of these are stamped steel, that in the center being of stainless steel, and the others are zinc-alloy die castings. Tubular parts in the foreground are vacuum cleaner tube couplings drawn from low-carbon steel and undergo rather severe working, so severe in fact that, on some, annealing is required after the initial draw to permit curling edges and bulging a ring near the center. With present variations in steel quality, the severe working is likely to result in fractures unless annealing is done.

As tubular parts of this type are exposed in service and require bright plating, they must have a clean surface and considerable luster before entering the plating baths. Formerly, hand wheel polishing was done and it required 6 hours of labor to polish 1000 parts. In barrel finishing, which includes descaling (necessary after annealing), bright honing in limestone chips and a final tumble in sawdust, besides some intermediate handling, the total labor is only 1¾ hrs., or a labor saving exceeding 70 per cent.

Descaling by tumbling is done in one hour, without chips, in water to which 6 lbs. of compound is added. At the end of this period, the compound is flushed out and is replaced by 6 lbs. of a compound which, in a 20-min. run, neutralizes the acid action of the first compound. Then the barrel is flushed thoroughly again, without removing the parts, and 700 lbs. of No. 4 limestone brightening chips and 6 lbs. of compound are added. Rolling is then done over night, or 16 hrs., after which the compartment is again flushed out with water and 6 lbs. of honing compound is added. Then the

barrel is run another 3 hrs. before being flushed finally. Some couplings are made in two parts, each of which receive the same treatment, except that one of the parts does not require annealing, hence the descaling operations are omitted.

After flushing, the load usually is dumped on a screen, one of which appears in Figure 3. This screen is shaken to let the chips sift into the pan below. Parts remain on the screen and are transferred to a wire basket in which they are dipped into light hot oil. Then the basket is placed in a spinner (centrifuge) for drying. Parts could then be plated, but have a somewhat hazy luster which is made considerably brighter by tumbling 1 to 1½ hrs. in sawdust, in a wood lined barrel.

Another steel stamping, called a toggle, and shown at top left in Figure 2 also requires plating. Formerly, it took 32 hrs. of wheel work to polish 600 of these parts. The same number is barrel finished with 1¾ hrs. of labor. No descaling is required, as the stampings do not need annealing. They are first run 16 hrs. in a load that includes 700 lbs. of special chips, 6 lbs. of compound, and enough water to cover the load. After this run, the barrel is flushed without dumping, 6 lbs. of another compound is added and the barrel is run another 3 hrs. before being flushed and dumped to separate parts from chips. After separating, dipping and drying, a 1 to 1½-hr. tumbling in sawdust follows to improve luster for plating. As the total labor saved on a batch of 600 parts exceeds 30 man hours, the cost decrease is very large.

Processing described in the foregoing paragraph was followed when parts were plated. Nickel shortages have since led to the use of a baked enamel finish in place of plating for this part and, for this finish, no bright honing is needed. Instead, the parts are first run for two hours without chips in water, to which 6 lbs. of compound is added. This treatment is chiefly for burr removal, but some surface scouring results. Labor, however, is only one hour, which includes loading, flushing, unloading, dipping and drying.

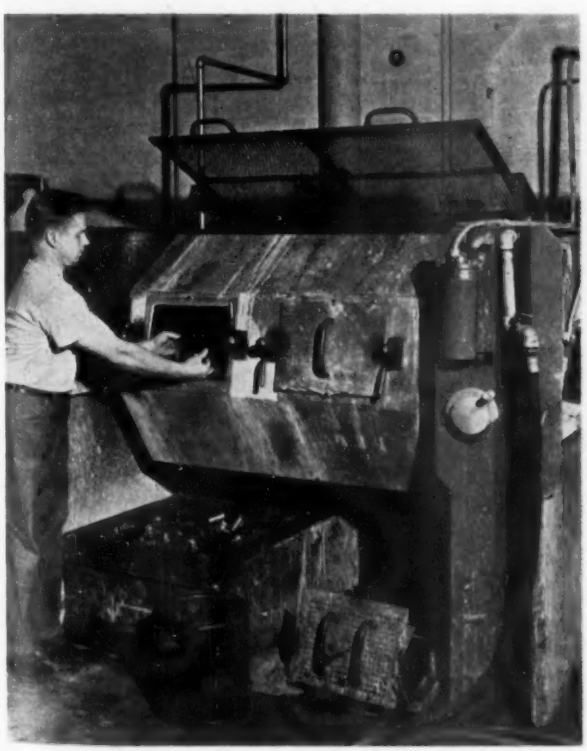


Figure 3. Unloading tubular steel parts that have been bright honed in the barrel shown. In general, both parts and limestone chips are dumped onto a hand screen. Chips drop into the pan below when the screen is shaken.

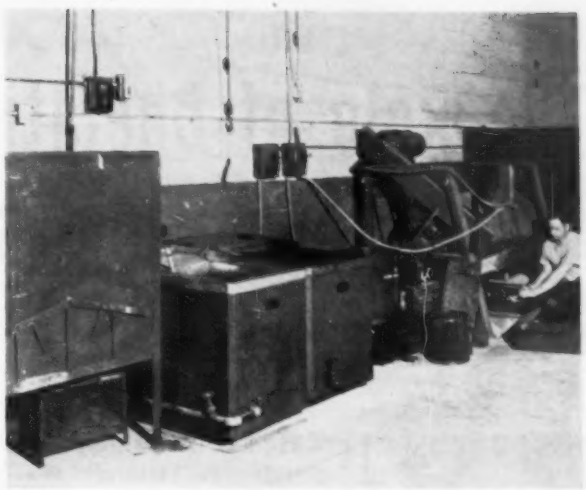


Figure 4. Barrel finish equipment that includes, left to right, a chip storage bin; two dip tanks, one for oil and one for hot water; a spin dryer and a barrel that is used with sawdust to add luster to parts previously brighthoned in the wet barrels, Fig. 1.

For the saucer shaped stainless steel part, center in Figure 2, the chief problem is to bright hone the surface, although, in the process, such light burrs as occur on the sheared edge are also removed. Treatment in this case consists of overnight tumbling of 500 pieces in No. 4 limestone chips to which 6 lbs. of compound and water to cover the load are added. This yields a bright finish. As this is a new part, not processed before tumbling equipment became available, no data on earlier processing exist.

Among zinc-alloy die castings processed are the somewhat wedge-shaped parts near the top of Figure 2. Until plating was discontinued because of nickel shortage, these parts were hand buffed on wheels at the rate of 40 pieces an hour. This gave place to barrel finishing over night of 800 of the larger pieces at a time. At the end of 16 hrs., the barrel was flushed out, after which 6 lbs. of compound was added and a 3 hr. tumbling followed.

Parts were then flushed, separated from chips, rinsed in hot water, spun dry and tumbled one hour in sawdust to bring up a luster. The same schedule is followed for the smaller of the two castings except that the load is 1000 instead of 800 pieces. In both cases, however, there is a large saving as compared with hand buffing on a wheel. At present, nickel shortages require that these castings be enameled instead of being plated and, as the castings are quite smooth, neither buffing nor tumbling is necessary, but appearance is not up to that for plated parts.

Although the equipment described above was installed primarily for bright honing, it is also used for deburring nine different steel stampings, including the smallest parts shown in Figure 2 and doubtless will be more extensively used for this purpose, especially if and when plating has to be curtailed further. In general, deburring would be done with granite chips or

(*Concluded on page 62*)

The Role of Chelating Agents in the Plating Industry

By Dr. Harold Narcus, *President & Technical Director, Electrochemical Industries, Inc., Worcester, Mass.*

BECAUSE of the limited amount of reference literature available, particularly in this country, dealing with the chemical and physical properties of chelating agents, the purpose of this paper is to bring to light some of the potentialities of these newly developed organic compounds. This treatise discusses first the more familiar sequestering agents; secondly, the commercial chelating agents, making a comparison between the two; and finally the present applications for chelating agents and their possible use in the metal finishing field.

The information herein is presented in such a way that a profound knowledge of physical or organic chemistry is not a requisite for a complete understanding of the behavior of these compounds.

Sequestering Agents

It is best to begin by reviewing the chemical and physical behavior of the more common sequestering agents so that a satisfactory differentiation may be made between these and the less-known chelating agents.

The electroplater has, without doubt, encountered the term "sequestering agent" on numerous occasions, especially during his perusal of technical literature dealing with methods for softening water. Perhaps these compounds were met with in the literature describing methods for counteracting the adverse effects of heavy metal ions such as those of Cu^{++}, Ni^{++}, Co^{++}, and other divalent ions or those of the common alkali earths such as those of Ca^{++}, Mg^{++}, Ba^{++} and Sr^{++}.

Actually, sequestration, in which chelation will be shown to be incorporated, is of comparatively recent origin. According to the dictionary, it means "the act of taking possession of by confiscating or appropriating." Chemically, it is the reduction of the concentration of a polyvalent positive ion (a Ca^{++}, for example) in solution by combination with a negative ion [like a $(PO_3)_6^{=}$] to form a different complex *negative* ion (in this instance, a complex calcium metaphosphate ion, $Ca(PO_3)_6^{=}$. The ultimate result is that the remaining concentration of the positive, polyvalent Ca^{++} is so low that it will not be precipitated by a given negative ion which normally would precipitate calcium, such as an oxalate ion. In other words, if you add an oxalate ion to a completely sequestered calcium solution no calcium oxalate will precipitate. Removal of calcium hardness from water — more commonly termed "water-softening" — is a well-known example of this chemical phenomenon. Sequestering agents such as sodium metaphosphate are actually water soluble ion exchangers, and their employment in water softening is an excellent example of the principle of sequestration. Fortunately, the quantity of agent necessary to carry out the combination described can be accurately determined. This "sequestration" value is the quantity of sequestering agent required to combine with or "sequester" a unit quantity of a polyvalent positive ion and form with it a complex negative ion which is stable against precipitation by a known precipitant for that particular polyvalent positive ion. This is a definite chemical value, better termed a stoichiometric value.

Experiment to Illustrate the Principle of Sequestration

To each of two 1000 c.c. beakers (A) and (B) add 500 c.c. of distilled water and 9½ c.c. of a solution containing 10 grams of anhydrous calcium chloride per liter (1% solution of calcium chloride). Each beaker will then have water with a calcium hardness of 171 parts per million, or 10 grains per gallon.

To beaker (B) only, add 6 c.c. of a 5% sodium metaphosphate solution (such as "Calgon").

Adjust the pH of both solutions (A) and (B) to 8.2 with 10 c.c. of a 10% sodium hydroxide solution.

Add 10 c.c. of a standard soap solution (1 c.c. is equal to 1 mg. of calcium carbonate) to both solutions.

Upon stirring the solution in both beakers it will be noted that there are no suds in Beaker (A) but copious suds formation in Beaker (B).

The sodium metaphosphate has sequestered the calcium ion in (B) preventing it from reacting with the soap to form an insoluble calcium soap, thus leaving the sodium soap free to form its characteristic suds. If additional 5% solution of sodium metaphosphate (about 10 c.c.) is added to Beaker (A) the calcium soap precipitation will re-dissolve and suds will be produced as in Beaker (B).

In the process of sequestration, the polyvalent positive ion (such as the calcium ion) has practically disappeared from the solution *without being evolved as a gas, removed as a precipitate, or deposited as an element, as in electroplating.* In other words, the Ca^{++}

ions are still in solution but the chemical characteristics normal to their simple ions are gone.

Graham's Salt $(NaPO_3)_n$, (where "n" equals the number of $NaPO_3$ units common to the polymeric molecule in solution) is a well-known commercial sequestrant and, chemically, is a neutral sodium metaphosphate. It is considered to be an efficient sequestering agent having many industrial applications.

The chemical reaction involved in this process of sequestration best illustrates the action of all polyphosphates and is as follows:

$$Na_2\,[Na_4\,(PO_3)_6] + Ca^{++} \rightarrow Na_2\,[Na_2\,Ca\,(PO_3)_6] + 2\,Na^+$$

(or)

$$Na_2\,[Na_4\,(PO_3)_6] + Ca\,CO_3 \rightarrow Na_2\,[Na_2\,Ca\,(PO_3)_6] + Na_2CO_3$$

We have seen in this treatment of hard water with Graham's Salt (as illustrated in the previous experiment) an ion exchange similar to the base exchange reactions of zeolites, but occurring entirely in solution, each positive calcium ion replacing two sodium ions in a complex negative ion. To prove that the residual calcium ion concentration is extremely low we can add soap, which normally forms a very insoluble salt with calcium ions but will not precipitate this insoluble calcium salt when sufficient Graham's Salt is present. We are most familiar with this insoluble soap formation in soap burnishing when insoluble, sticky precipitates form with hard water. Conversely, Graham's Salt will dissolve precipitated calcium soaps.

It is important to point out again that no calcium actually has been removed in this sequestration process by volatilization, plating out, or precipitation, and a true solution remains. Still, the calcium ion is no longer present in more than a minute amount (of the order of a few parts per million). This, therefore, reveals the basic principle of "sequestration." Actually, in this process, the calcium ion has lost its chemical or "ionic" identity.

The sequestration of the calcium ion as described is affected by the pH of the solution but is not primarily a pH effect. Thus, calcium carbonate will dissolve in acid and *not* in alkali, but it can be made soluble in alkaline solution by the addition of an addition agent such as neutral sodium metaphosphate.

Other divalent metal ions can likewise be sequestered to a greater or lesser degree; for example, ions such as Ba^{++}, Sr^{++}, Mg^{++}, Fe^{++}, Co^{++} and Ni^{++}. Furthermore, trivalent ions such as Fe^{+++}, Al^{+++}, etc. are sequestered, but to a lesser degree than the divalent ions, and do not appear to be so tightly held in a complex negative ion. Unstable complexes result with the heavier monovalent cations such as silver.

This sequestration phenomenon is not just a laboratory curiosity but rather has found wide commercial applications. As previously noted, it is principally employed in the softening of water which is to be ultimately used with soap. We, in the plating field, realize the importance of soft water in the plating-room. It is a well-established fact that water good enough for drinking is not necessarily good enough for use in processes such as electroplating. Hard water is a constant problem to platers in certain parts of the country. All natural water, with the exception of rain water, contains some calcium and magnesium ions (the parts per million varying in different geographical locations) and these ions of calcium and magnesium form insoluble precipitates or scums with soap — a most objectionable factor in the subsequent electroplating of metals. Insoluble scum or film formation on work which has been burnished is an objectionable occurrence known to all in the metal finishing field.

Before a soap can form a good lather, which is an attribute of the alkali metal soaps, it must be first added in sufficient amounts to precipitate the calcium and magnesium ions, these being the so-called water "hardness" constituents. By employment of a suitable sequestering agent such as sodium metaphosphate this precipitation can be prevented, and a lather formed with considerable less soap.

Other sequestering agents are known, but are active to a lesser degree. Reference is made to sodium pyrophosphate, tetra sodium pyrophosphate, sodium tetraphosphate and sodium tripolyphosphate.

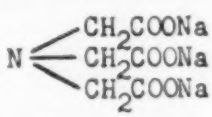
One disadvantage of all polyphosphates is that the higher the concentration of the water hardness salts, the lower the efficiency of the polyphosphates. This is not true in the case of the chelating agents now to be discussed.

Chelating Agents

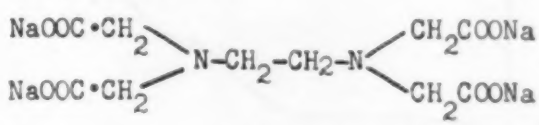
With this preliminary discussion, we are now more fully prepared to cope with the term "chelating" agent and the principle of chelation. The main differences between the previously discussed sequestering agents and the chelating agents will become evident. It may be stated here, however, that the chelating agents generally concern themselves more in the realm of organic chemistry than the sequestering agents, which we normally consider inorganic in their chemical characteristics.

Chemically, a chelating agent is a compound which will inactivate a metallic ion by forming an *inner ring structure* in the molecule, the metallic ion becoming part of the ring. A sequestering agent is any complexing compound which forms a water-soluble metal complex compound.

Around 1948, a compound[1] known as Trilon A was investigated. This compound had the following structural formula:

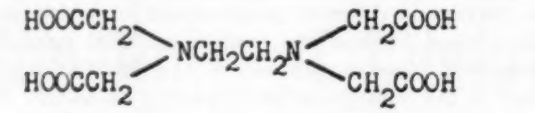


From this organic structure resolved the modern chelating agent, Trilon B:

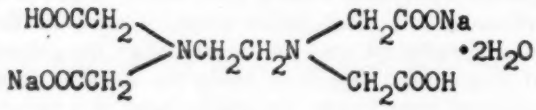


This compound[2] is the tetra sodium derivative of a synthetically prepared polyamino acid, ethylene diamine tetraacetic acid. There are now commercially available various types of chelating agents known as *Versenes*[3] and *Sequestrenes*[4] *having the forms shown in* Table I.

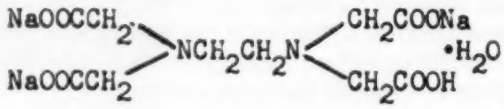
Table I—Various Forms of Chelating Agents



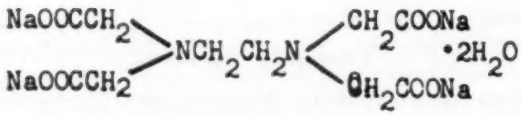
Ethylenediamine Tetraacetic Acid



Disodium - EDTA



Trisodium - EDTA



Tetrasodium - EDTA

The polyamino acid, ethylene diamine tetraacetic acid (EDTA), is only slightly soluble in water, but its sodium salts are more readily soluble. For example, the disodium form of EDTA is 3% soluble in water, and the tri- and tetra-sodium forms of EDTA are highly soluble. Commercially, the EDTA and its sodium derivatives are available as white, non-hygroscopic crystalline powders. The tetra-sodium derivative of EDTA is also available as a colorless liquid.

The EDTA has a pH of 2.8 while its di-, tri and tetra-sodium salts have pH's of 4.8, 8.8 and 10.5 respectively.

Figure 1 shows the existence in solution of the various salts of ethylene diamine tetraacetic acid resulting when base is added to a stirred suspension of EDTA.

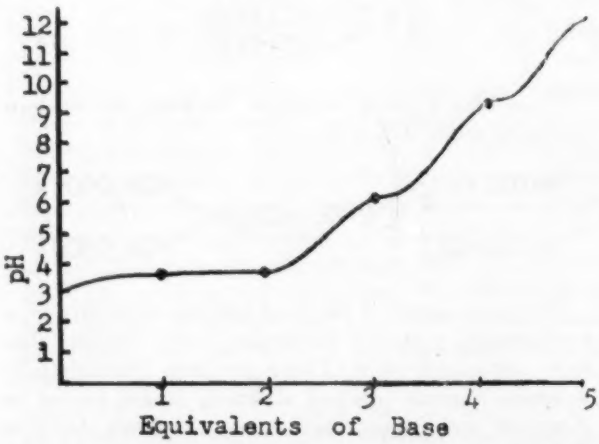


Figure 1. Formation of various forms of EDTA by addition of base.

The reversibility of the reaction involved is shown in the following chemical reaction:

$$H_4Y \underset{H^+}{\overset{OH^-}{\rightleftharpoons}} NaH_3Y \underset{H^+}{\overset{OH^-}{\rightleftharpoons}} Na_2H_2Y \underset{H^+}{\overset{OH^-}{\rightleftharpoons}} Na_3HY \underset{H^+}{\overset{OH^-}{\rightleftharpoons}} Na_4Y$$

in which "Y" is a simple way to represent the ethylene diamine tetraacetic acid residue from which four protons have been removed. It signifies a terminology adopted by investigators in the field of chelation.

These chelating agents in the variety of chemical forms are not actually conventional sequestering agents, such as the polyphosphates previously discussed. In spite of widespread industrial use, they have received very little attention in the technical literature published in this country. Investigators[5,6,7] in Germany and Switzerland, however, have studied these materials and related compounds very thoroughly, and their findings are just beginning to appear in English in this country. Presently, there are at least two companies[3,4] manufacturing these organic chelating agents and their derivatives on a commercial scale in this country and they are available at reasonable prices.

These substances, because of their special nature, are termed organic chelating agents rather than the more general term of organic sequestering agents or sequestrants. As will be shown presently, they form *inner* salts or *chelate complexes* which account for their chemical behavior in solution. While chelating agents have most of the properties of the ordinary sequestering agents, they form more stable reaction products, known as the chelate of the metal, and these chelates are quite stable over a wide range of pH; they are not decomposed by either weakly acid or highly alkaline solutions. Temperature, time and the addition of common precipitation agents have no effect on these chelated metal ions. On the other hand, sequestering agents do not actually form this stable a complex, but rely on the dispersion action of the reagents. Coagulation is prevented by the sequestering agent to achieve the desired result, but eventual coagulation may take place gradually. The polyphosphates excel the chelating agents only in "threshold effect" — that is, the polyphosphates temporarily inhibit precipitation of a metal ion even though there is not enough polyphosphate present to completely complex the metals present. This phenomenon, which is not an attribute of chelating agents, is probably due, as stated, to physical dispersion.

The sodium salt of EDTA has been shown to be four times more effective than the inorganic polyphosphates. It is not recommended for use in strong oxidizing solutions since it will be oxidized to a cyclic structure. Permanganates and hot acid dichromates will bring about this change in the chemical structure of the compound. Sulfides will also break up the chelate formation because of the solubility products of sulfides, which are of such a magnitude that precipitation is favored.

These organic chelating agents have the ability to form soluble *non-ionic* chelates with such polyvalent ions as Cu^{++}, Co^{++}, Ni^{++}, Zn^{++}, Fe^{+++}, Al^{+++}, etc. The result is a complete change in the property of these ions in solution. In other words, as in the process

of sequestration, chelation prevents the metal ions from being precipitated by a common agents which under normal conditions would cause precipitation. For example, the Ca^{++}, will not be precipitated by an oxalate-bearing compound since it is tied up in this non-ionic form.

It is important to point out that the complexes formed with these chelating agents become *less stable as the pH is reduced and show maximum stability at high pH's.* This factor should be remembered when considering applications for these compounds. Furthermore, the chelating power with ions of heavy metals such as copper, cadmium, tin, zinc, lead, manganese, nickel, cobalt and other divalent metals is stronger than with the alkaline earths such as calcium, magnesium, barium and strontium. In most cases, the higher the valence of the metal ion the greater is its tendency towards chelation. This is by no means a definite rule, since certain conditions may alter this, but chelate complexes are also formed with such trivalent metal ions as Al^{+++}, Fe^{+++}, and Cr^{+++}.

In general, it may be stated that most metals are chelated above a pH of 5, while heavy metals may be chelated at somewhat lower values of pH. It is well to again point out that *the higher the pH the greater the chelating power.*

Comparing the reaction of the Ca^{++} with Graham's Salt and the reaction of this same ion with the sodium salt of EDTA, we arrive at the following:

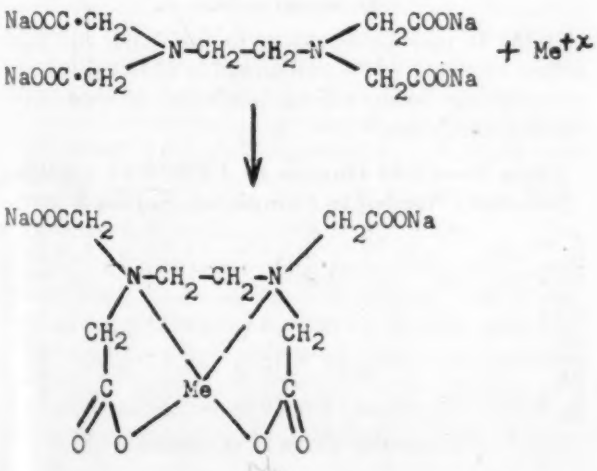
$$Ca^{++} + Na_4Y \longrightarrow Na_2(CaY) + 2Na^+$$

where

$$Y = \begin{matrix} -OOC\cdot CH_2 \\ -OOC\cdot CH_2 \end{matrix} \!\!> NCH_2CH_2N <\!\! \begin{matrix} CH_2COO^- \\ CH_2COO^- \end{matrix}$$

The brackets in the formula for the calcium complex indicate that the calcium is bound up in a non-ionic complex with the sodium salt of EDTA. As in the process of sequestration, the calcium ion loses its chemical or ionic identity in this process of chelation.

A general reaction to illustrate the chelation of any metal ion capable of being chelated is shown in the following reaction:



Figures II and III show the chelating power for Ca^{++} as a function of pH and temperature.

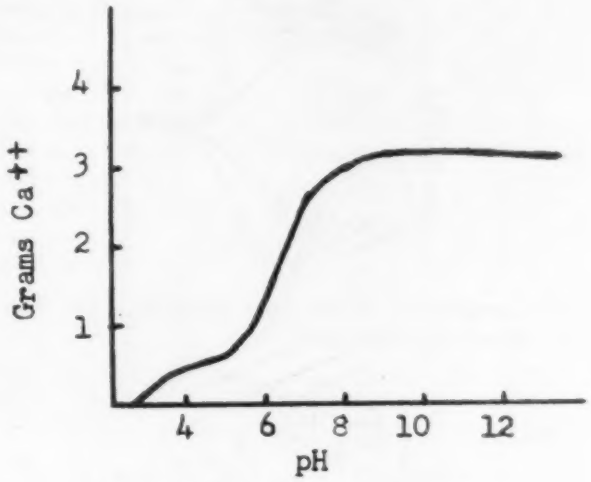


Figure 2. Chelating power as a function of pH.

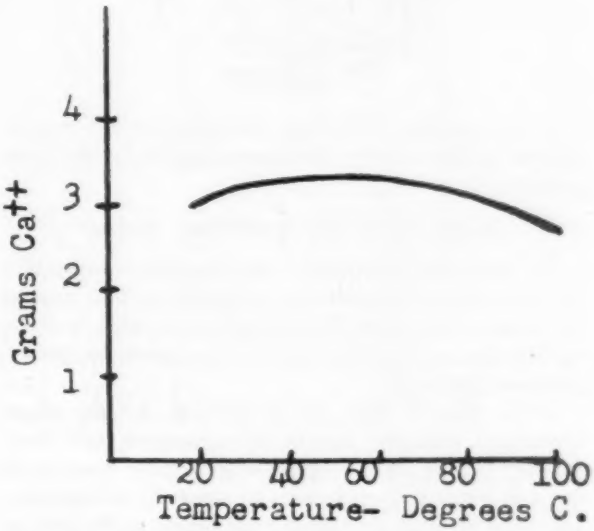
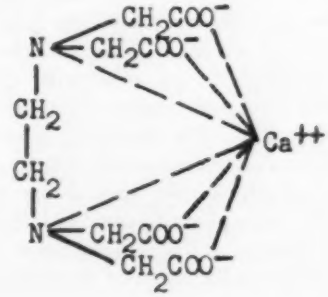


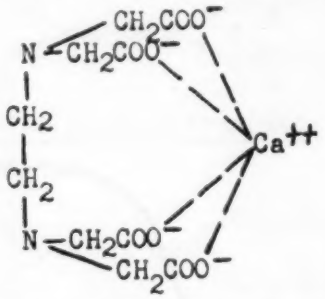
Figure 3. Chelating power as a function of temperature.

The exact structure of the calcium chelate complex and other metal complexes has been investigated. Suffice it to say that it is not a definite structure. For the benefit of those interested, the structure has been postulated to be one of the three forms indicated below, form (3) being the most probable:

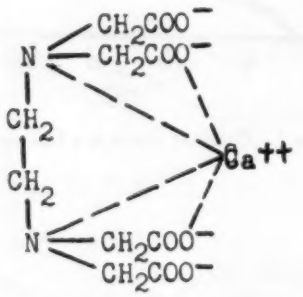
(1) Coordinated With All Four Carboxyl Groups and Two Nitrogens



(2) Coordinated With Only the Four Carboxyl Groups and No Nitrogen Atoms



(3) Coordinated With Two Nitrogens and Two Negative Carboxyls



As stated, other structures are possible, but experimental evidence shows the preceding to be the most probable[7,8]

Applications for Chelating Agents

The foregoing discussion was presented in order that there be some understanding of the theoretical aspects of complex formation. This should be of value in determining the applicability of chelating agents to specific practical problems.

At the present time, the applications for the aforementioned chelating agents are numerous, and their number will increase tremendously as these compounds become better known. It must be remembered that they represent recently developed compounds in the field of organic chemistry and their progress will undoubtedly parallel that made in the field of wetting agents. When the latter were first investigated their uses were also limited, but today they have unlimited applications.

However, some uses for chelating agents are definite and tested applications beyond the laboratory stage. The following represent some of the principle ones now in use in the metal finishing and other allied fields.

Softens Water Without the Formation of Precipitates

As pointed out numerous times in this treatise, these chelating agents form non-ionic compounds with the alkaline earths and other metallic ions which we know to be the cause of hardness in water. The complexed compounds resulting *do not* react with soap or other reagents which commonly cause objectionable precipitates with these ions. The chelating agent effectively removes this hardness from water and does so *without the formation of precipitates* such as are formed with ordinary water softening agents. Therefore, another important advantage in the employment of chelating agents is the fact that filtration of the water so softened is not necessary. In fact, it has been shown that such materials assist in the cleansing and foaming action of the soap and thus serve a multiple purpose. It should be pointed out, however, that these chelating agents are not wetting agents as we know them; neither do they foam appreciably nor have noticeable detergent action.

High temperatures have no effect on the stability of these compounds and their resulting complexes and hence, they may be used at any temperature. Their action is also effective for indefinite lengths of time. Fortunately, complete softening of water is usually not necessary and less chelating agent may be used than required by calculations.

Figures IV and V show the chelating power of the commercial sodium salt of EDTA when used in the dry powder form and as a 34% aqueous solution:[9]

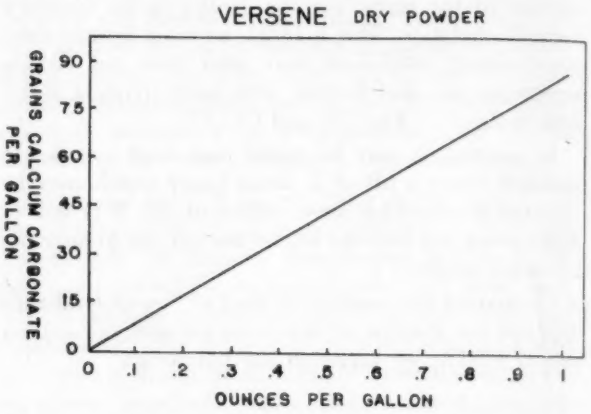


Figure IV. Chelating Power of a Commercial Chelating Agent (dry powder form).

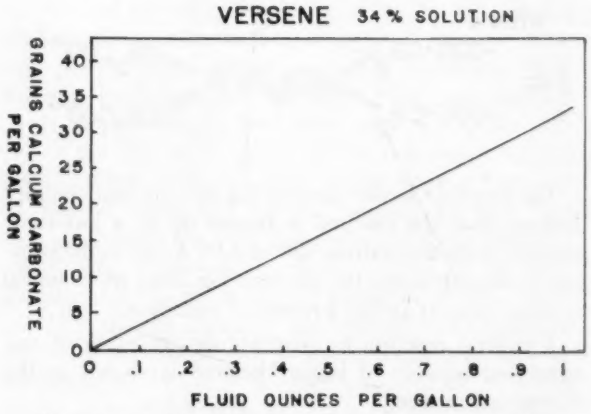


Figure V. Chelating Power of a Commercial Chelating Agent (34% aqueous solution).

Table II may be employed to determine the fluid ounces of a 34% of the sodium salt of EDTA necessary to completely soften various quantities of water with varying hardnesses.[9]

Table 2—Fluid Ounces of VERSENE (34% Solution) Needed to Completely Soften Water

HARDNESS IN GRAINS PER U.S. GALLON	5	10	15	20	25	30	35	40	HARDNESS IN PARTS PER MILLION
1	1/6	1/3	1/2	2/3	5/6	1	1 1/6	1 1/3	17.1
5	5/6	1 2/3	2 1/2	3 1/3	4 1/6	5	5 5/6	6 2/3	85.5
10	1 2/3	3 1/3	5	6 2/3	8 1/3	10	11 2/3	13 1/3	171
15	2 1/2	5	7 1/2	10	12 1/2	15	17 1/2	20	256
20	3 1/3	6 2/3	10	13 1/3	16 2/3	20	23 1/3	26 2/3	341

GALLONS OF WATER TO BE SOFTENED

Dissolves Scale and Other Extremely Insoluble Deposits

A chelating agent will not only keep metal ions in solution in the presence of precipitating agents for the metal ions, but will also dissolve insoluble metal salts after they have been previously precipitated. A chelating agent, when added to water and used in various types of equipment, will dissolve such common objectionable deposits as calcium sulfate, alkaline earth carbonates, and insoluble phosphates.

The following reactions are typical of this application:

(1) $CaSO_4 + Na_4Y \rightarrow (Na_2\ (Ca\ Y) + Na_2SO_4$.

(2) $MgCO_3 + Na_4Y \rightarrow Na_2\ (Mg\ Y) + Na_2CO_3$.

(3) $Ca_3\ (PO_4)_2 + 3\ Na_4Y \rightarrow 3\ Na_2\ (Ca\ Y) + 2\ Na_3\ PO_4$.

(4) $BaSO_4 + Na_4Y \rightarrow Na_2\ (Ba\ Y) + Na_2SO_4$.

(5) $CaC_2O_4 + Na_4Y \rightarrow Na_2\ (Ca\ Y) + Na_2C_2O_4$.

The commercial chelating agents will dissolve the above precipitates even though such precipitates usually have maximum insolubility in bases.

The chelating agent used in this application has the advantage that the process may be carried out while the equipment is in regular use. Since it acts in both neutral and alkaline solutions, its use avoids the difficulty of bringing metal parts of the processing equipment in contact with the harmful acids which usually would be used to dissolve such hard objectionable scale deposits.

Saponify Fats

A chelating agent is a buffering agent and has sufficient reserve alkalinity to saponify fats, grease, oils, etc. Usually a small amount of wetting agent is used in conjunction with the chelating agent.

Liquid Soap Preparations

In some cases, liquid soap preparations become hazy or cloudy because of the presence of traces of materials which precipitate fatty acids or their salts. Such precipitates are unsightly and sometimes settle out as a flocculent solid or sediment. The chelating agent removes these precipitates completely when added to these liquid soap preparations in even small amounts (.1%). This action is due to the removal of interfering metal ions by the formation of inactive and stable complexes of the chelating agent. Soap solutions so treated may be stored indefinitely without loss of clarity. Sequestering agents such as the polyphosphates discussed earlier in this article decompose gradually upon standing and hence are less effective in this application. Reduction in the soap film formation and a resultant improvement in rinsing properties also is evident upon employment of the chelating agent in these liquid soap solutions.

Removal of Metallic Impurities

This is an application which undoubtedly is of greatest interest to those in the electroplating field. It may be the long-sought-after method by which metallic impurities can be effectively removed from plating baths, cleaners, processing solutions, etc. so that they can again operate more efficiently. Employing chelating agents intelligently, these interfering metallic impurities, even in trace amounts, can be removed or inactivated. The logical question to ask, however, would be — how can we remove an impurity such as iron, zinc, copper, lead from a nickel plating bath, or copper from a 24 Karat gold bath without removing the nickel in the first instance or gold in the second? A great amount of research is presently being carried out in this field, and the results obtained are most promising. The approach to success in this project is due to the fact that several factors are now known about chelating agents which enable us to create the proper conditions under which we can enable the chelating agent to do what we want it to do. It is hoped that, after presentation of the following facts, the answer to the question offered will be fairly evident.

The most important observations regarding the selective chelation of metallic ions is presented in the following paragraphs:

(1) The difference in the tendencies of various metals to form complexes with a chelating agent is one factor which makes for the efficient and effective separation of metals from each other. For example, when two metals show approximately equal tendencies to form a precipitate with a certain reagent they cannot be effectively separated by using that particular reagent. However, in the presence of a chelating agent, under selected conditions, they show widely different tendencies to undergo complex formation with that agent. Hence, the addition of a suitable amount of chelating agent to a solution of both metals as, for example, in a plating bath, will result in preferential complex formation with one of them. Under these selected conditions, therefore, the activity of the ions of the objectionable metal (the impurity) is greatly reduced, if not completely eliminated. It is evident in view of this that the chelating agent may be considered a convenient reagent for the reduction of the activity of the undesirable metallic ions in solution.

(2) The chelating agents form soluble stable complexes with most metals except the noble metals. This is another factor which makes the separation of metals feasible. Using this principle we can employ a chelating for the removal of copper from a cyanide gold solution. In this example, the copper is chelated prior to the gold which, incidently, would be chelated only slightly if at all under the proper conditions.

Table 3—Log K Values of some common metals

Sodium (Na^{++})	1.66
Lithium (Li^{++})	2.79
Barium (Ba^{++})	7.76
Strontium (Sr^{++})	8.63
Magnesium (Mg^{++})	8.69
Calcium (Ca^{++})	10.59
Iron (Fe^{++})	14.45
Zinc (Zn^{++})	16.58
Cadmium(Cd^{++})	16.58
Cobalt (Co^{++})	16.9
Lead (Pb^{++})	17.7
Nickel (Ni^{++})	18.0
Copper (Cu^{++})	18.86
Chromium (Cr^{+++})	19.8
Iron (Fe^{+++})	25.00
Chromium (Cr^{++++++})	26.00

(3) The log K value of each metal is still another important factor. This value is often termed the "equilibrium formation constant" or the "stability constant" (the reciprocal of this value being the "dissociation constant"). *The higher the log K value, the more stable the complex and the stronger the tendency for complex formation.* For example, the Ca^{++} will chelate before the Mg^{++} ion because the former has a large log K value and likewise the Cu^{++} will complex before the Ca^{++}.

Table III shows the latest available values for several common metals:[10]

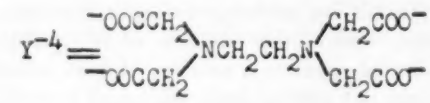
The log K values shown in Table III were determined at pH4, using a Beckman Model D. U. quartz spectrophotometer.

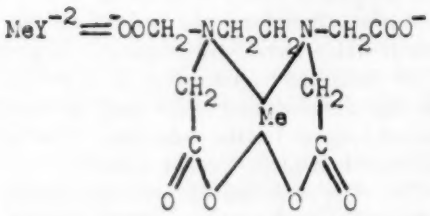
The actual calculation of the log K value for a certain metal is carried out as follows:

$$Me^{+2} + Y^{-4} \rightleftharpoons MeY^{-2}$$

$$\text{log value of } K = \frac{(MeY^{-2})}{(Me^{2})\,(Y^{-4})}$$

where, Me^{+2} = metal ion concentration.





(4) The factor of competing ions will also result in preferential chelation. For example, in a solution of calcium and magnesium at pH 9 the calcium is chelated in preference to the magnesium, but in the presence of another anion such as an oxalate the calcium will be precipitated leaving the magnesium chelated.

(5) The factor of pH value may aid separation. Heavy metals may be chelated at lower values of pH than the lighter ones. The pH point at which the chelate efficiency is of low magnitude and chelation stops varies from metal to metal, although the complexing efficiency of the chelating agent does not decrease very noticeable until low values of pH (in the order of .5-1.5) are reached, with the exception of the alkali earths (Ca, Mg, etc.).

Chelating agents find their greatest use in alkaline solutions since the chelating power increases as the pH rises. However, even at low pH values only more of the chelating agent may be needed to accomplish the effect — to counteract the reduced efficiency in these acidic solutions.

An excellent example to illustrate the effect and importance of pH control is the fact that at a pH of 2 the efficiency of copper chelation is only 50%, but at a pH of 3.5 it is 100%.

Table IV shows the preferential chelation of metals at several values of pH:[9]

Table 4—Preferential Chelation of Metals at Several Values of pH

pH 4.00	Cr, Cu, Ni, Pb, Co
pH 6.50	Ni, Cu, Co, Zn & Cd, Ca
pH 8.65	Ni, Co, Cu, Zn & Cd, Ca, Mg, Sr, Ba
pH 11.00	Co, Ni, Cu, Zn & Cd, Ca, Mg, Sr, Ba

Note: In the above Table, the metal to the left is more strongly complexed than the metal to the right at the pH indicated. The pH was controlled by preparing the complexes in buffer solutions.

(6) The apparent efficiency of the chelating agent increases with the atomic weight of the metal. The chelating agent, in other words, is more effective for the heavier metal ions than the lighter ones. For example, one mol. of EDTA will chelate 24 grams of magnesium ion (1/10th of its own weight) but 207 grams of lead ions (2/3rds of its own weight). In practice, it has been found, incidently, that 500 grams of the sodium salt of EDTA will chelate 1 mol. of metallic ions. This refers to the dry powder. The same quantity of 34% commercial solution will chelate 1/3rd as much of the metallic ion.

The efficiency of any complexing agent is dependent to a great extent on other compounds which are present. There is always present a constant interplay of forces acting on a chelated metallic ion. Complexing agents of the type discussed tend to chelate metallic ions, while precipitating agents tend to upset the complex formed and cause precipitation of the metallic ion as an insoluble compound. It is evident that the stronger the complex, the less effective the precipitating agent will be in this tendency to precipitate the ion. This, therefore, brings into consideration the matter of "solubility products." A "solubility product" is the product of the activities or concentrations of ions in an electrolyte. Therefore, the ability of a chelating agent to prevent the precipitation of a salt will depend on the difference between the solubility of the salt and the "dissociation constant" of the chelating complex. It was noted previously that the dissociation constant is the reciprocal of the stability or formation constant (1/K). *If the latter (dissociation constant) is smaller than the former (solubility product) precipitation will not occur.* It is our desire in the chelating process that this be the case.

The six factors which may determine separation of metallic ions from one another are by no means ironclad rules since, as pointed out, many conditions may alter the picture, but they offer some assistance in ion separation. Present laboratory investigations are being carried out keeping the aforementioned factors in mind. Certain separations of one metallic ion from another are no problem whatsoever but, where the interfering metallic ion and the ion of the principle metal are close in log K values, atomic weight, etc., closer examination of the problem is necessary. It is well to remember, however, that the magnitude of the impurity is very small when compared to the concentration of the principle metallic ion, so that even if a small amount of the

latter were chelated at the same time the undesired metallic ion was complexed, we would still accomplish our purpose.

In utilizing chelating agents for the purpose of removing metallic impurities, it should be kept in mind that in the chelation process, the reaction will continue until all the chelating agent is used up, and when one metal ion is completely inactivated another ion will then be inactivated. Furthermore, a metallic ion which is capable of forming a stronger chelate compound will tend to displace another metal from its chelate compound unless, of course, they are fairly close in stability or formation constant values.

It is best to determine by analysis the concentration of the metallic impurity and use the calculated amount of chelating agent. It has been noted, however, that these calculated amounts are not always necessary, probably because of the complex systems involved in the process of chelation.

When large amounts of the sodium salt of EDTA are used, the pH of the chelating agent should be lowered with H_2SO_4 to a suitable value depending upon the pH of chelation. This is necessary because of the fact that the commercial solution of the sodium salt of EDTA is supplied in highly alkaline form (pH 10.5).

Employment of Chelating Agents in Cleaner Baths

The commercial chelating agents are recommended for use in cleaner baths. For this purpose, the polyphosphates with their limited stability at high temperatures and high alkalinity are often unsuitable. The chelating agent, on the other hand, will readily withstand alkalinity of high value and the rather high temperatures of the usual metal cleaning bath indefinitely. This prevents the precipitation of calcium phosphates, silicates, carbonates, etc. which contaminate a metal surface whenever hard water is used. The chelating agent will also prevent the contamination of the metal surface by soap or rosin acids. Metallic soaps which are the cause of sticky, scummy films on work which has been burnished after plating in acid-type electrolytes (due to drag-in of acid) are nicely dissolved by adding a small amount (.1%) of chelating agent to the burnishing compound.

The chelating agent is particularly effective in stabilizing metasilicate baths. On prolonged heating, these baths will throw out a colloidal precipitate (presumably silica). As little as .1% of the sodium salt of EDTA will prevent this.

When employed in a neutral or alkaline solution it will remove rust and tarnish. For example, at pH of 7 it will clean non-ferrous metallic surfaces of oxide films. The advantage of using the chelating agent for this purpose is evident. There will be no hydrogen embrittlement, due to the absence of acids, and no toxicity problem inherent in the use of cyanides. The chelating compound, itself, shows evidence of being a good cleaner and degreasing agent.

Use in Anodizing

In anodizing, the chelating agent has been useful to counteract the effect of dissolved metallic ions on the dye shades. Faulty dyeings are often caused by interfering traces of calcium, magnesium, iron, copper, tin and other metals present in the dye baths, either as a result of corrosion of fittings and dye vats or inadvertently introduced because of low grade water supplies or rusting and scaling of water pipes and overhead structures. The end-result, in any case, causes streaking, spotting, dullness, poor color yields and serious color changes.

Below is given just a few of the many examples which could be given to show the effect of metallic impurities on dye shades:[10,11]

Dye	*In Presence Of*	*Effect*
Benzo-purpine	Copper	bluer
Columbia orange	Copper, tin	yellower
Chrysamine yellow	Copper	redder
Benzo-brown	Copper	redder

Use of Chelating Agents In Plating Baths

It has been shown that the metallic complex is in chemical equilibrium with *free* metallic ions, but the reaction in the direction forming the metal chelate greatly predominates. The actual concentration of these free metallic ions is, in the majority of instances, lower than the value required by the solubility relationship (i.e. solubility product factor) to cause precipitation. As a result, the metal cannot be precipitated from the complex formed by the common precipitating agents. However, solutions of chelated metals do contain small but detectable amounts of *unchelated* metallic ions. Even in their small concentration, these metallic ions in ionic form may be replaced in solution by another metal which is higher in the electromotive series of metals.

An excellent example of this is the basis for a recently developed bath for coating iron and steel with copper by immersion:[9]

Copper sulfate, $CuSO_4 \cdot 5H_2O$	— 5 oz./gallon
Versene Dry Powder	—13 oz./gallon
Duponol ME	— 0.07 oz./gallon
pH (adjusted with H_2SO_4)	— 4-5
Temperature	—40-60°C. (104-140°F.)
Immersion Time	— 1-5 minutes
Copper Thickness	— 0.02-0.03 mils

The above bath offers excellent immersion deposits of copper on steel. These deposits are bright, continuous, dense and very adherent. The bath has low toxicity, enabling easy disposal of used solutions and ease in handling. The life of the solution is excellent.

Further information concerning this bath is obtainable from the supplier of the chelating agent used.[3]

Details regarding the employment of chelating agents in other plating baths such as the tin fluoborate, Rochelle copper and brass baths are also available from this supplier.[9] Several other types of plating electrolytes are still under investigation.

One investigator,[12] in a published report presented the following formulations for copper and zinc plating, but experiments with these baths as performed by the writer reveal that the solutions have little value as presented:

Zinc Plating	*Copper Plating*
60 gms. Sodium Carbonate	82 gms. Sodium Carbonate
30 gms. Polyamino acid	29 gms. Polyamino Acid
29 gms. Zinc Sulfate	12½ gms. Copper Sulfate
1000 gms. Water	2000 gms. Water
plus Sodium Hydroxide to raise pH to 10-11	10 gms. Gelatin

For Iron Removal

Special types of chelating agents have been developed for iron removal at pH's of 3.5-12. Some will not chelate alkali earth ions or other ions while removing or inactivating the ferric ion. Commercially, there is available a complexing agent for metal ions and specifically ferric ions; one for ferric ion *only* in the pH range of 3.5 to 12, and still another for metal ions and ferric ions at higher pH values such as a pH of 12 or over.

Other uses for chelating agents, while of great importance, warrant only mention in this treatise. Reference is made to their use as analytical agents[9,11] and in the atomic energy program.[13] The basic principle involved in the employment of chelating agents in analytical work is that the metal being analyzed complexes with selected dyes giving a definite color — the chelating agent, when added, complexes the metal to give a sharp color change. In the government publication reference is made to the use of chelating agents with soaps for removal of radio-active contamination.

Conclusion

It is hoped that the facts presented will enable those interested in these chelating agents to find uses for them in their particular operations, but, since conditions vary in each plant, certain deviations from the points outlined may have to be made. The sensible procedure to follow when testing these compounds in some particular application is to initiate investigations on a laboratory or pilot scale. Whether or not the chelating agent will do what is desired is a matter of trial. Just as others have found under the same circumstances, the results may be enlightening.

Acknowledgments

The writer wishes to express thanks to *Dr. John J. Singer*, Bersworth Chemical Co., Framingham, Mass. for the various data offered by him for use in this article; to *Dr. Frederick C. Bersworth* of the same company for allowing the writer to use certain information which also appears; to *Mr. H. W. Zussman*, Alrose Chemical Co., Providence, R. I. for permitting the employment of additional material accumulated by his company.

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BARREL FINISHING

(*Concluded from page* 53)

synthetic abrasives that cut much faster than limestone but, in this plant, deburring is being done without the usual chips or coarse abrasive.

Such deburring is done here, in a typical case, by adding to about 1000 stampings 6 lbs. of compound and water sufficient to cover the load. If burrs are heavy, however, about 15 lbs. of a special compound is added. This includes quite small but fast cutting chips that have proved effective. Such deburring eliminates some formerly done by hand and some dry tumbling in open barrels that was less effective.

While the special compound serves for the stampings now deburred and makes it unnecessary to stock or handle grinding or equivalent larger chips, such a compound is applicable only to parts in which the abrasive in the compound will not lodge in work pieces. After tumbling in this medium, it is removed by screening. All deburring is followed by flushing the barrels, by dipping parts in oil and by spinning dry. Naturally, the tumbling, in addition to burr removal, produces a scouring action on exposed surfaces and tends to slightly round sharp edges.

Equipment whose use is here described has been in use only a few months, but the economies already attained have been highly satisfactory and have resulted in large economies. It is expected that these will be extended to other parts in the corporation's own products as well as to some defense items, as the latter come into production.

CORRECTION

In the January issue, in Table 1, Page 68 of the article "Insulation for Plating Racks" there was an error in the method for applying Organosol-type coatings. Instead of reading "dip in plastisol" the directions should have read "dip in organosol and bake at 300-350°F."

The Nickel Situation

Abstracted from the 1952 Annual Report* of the Select Committee on Small Business of the United States Senate, Senator John Sparkman (Alabama), Chairman.

THE utter dependence of the United States on foreign sources for some strategic metals finds one of its most dramatic demonstrations in our almost total lack of nickel-bearing ore deposits. With respect to nickel we are a have-not nation to the extent that our industrial system can exhaust our domestically produced nickel for any given year in three working hours! This picture becomes darker when it is realized that the stated 1952 requirements of the free countries of the world for nickel are 200 percent of available supply. It is no wonder then that nickel has been in extremely short supply since July 1950, and is, in fact, becoming more desperately critical each passing day.

The diversified and extremely useful properties of nickel are responsible for the great increase in its use. It is strong and tough and resists wear. When alloyed with steel, it produces an alloy stronger, tougher, and more resistant to wear than steel alone. Nickel steel is used at temperatures as low as 300° below zero which tend to make ordinary steel brittle and subject to being broken by shock. It will not rust and resists corrosion by salt water and many acids. When alloyed with steel and other elements the product is resistant to very high temperatures. Nickel stabilizes this superalloy at high temperatures, making it suitable for use in jet engines, gun recoil systems, bomber fire walls, and aircraft exhaust valves which must not corrode and must be able to withstand very high temperatures. A recent survey showed that over 3,000 alloys in current use contain nickel.

Annual Average Consumption of Nickel in the United States During 1946 to 1949, Inclusive

	Short tons	*Percent*
Ferrous:		
Stainless steels	15,374	19.0
Other steels	17,058	21.0
Cast iron	3,638	4.5
Nonferrous	25,072	31.1
High-temperature and electrical resistance alloys	5,538	6.9
Electroplating anodes	11,385	14.2
Electroplating solutions	570	.7
Catalysts	451	.6
Ceramics	180	.2
Others	2,840	1.8
Total	82,106	100.0

The question immediately arises: If nickel is so important to the United States, and particularly as a part of a mobilization program, why have we allowed such a shortage to arise? The basic answer is that production of nickel in the United States has been limited to tiny amounts as a byproduct of other ores. The Economic Almanac for 1950 lists the United States as only 1 percent self-sufficient in nickel.

Salient Statistics for Nickel, 1946-50

	1946	1947	1948	1949	1950
United States:					
Production:					
Primary, short tons	333	646	933	790	913
Secondary, do	9,248	9,541	8,850	5,660	8,795
Imports (gross weight) [1], do	104,734	88,408	106,939	97,144	97,287
Exports (gross weight) [2], do	7,977	12,037	9,184	[3] 4,471	3,645
Consumption, do	89,105	86,757	95,556	98,326	98,904
Price per pound [4], cents	31½–35	35	35½–40	40	40–50½
Canada:					
Production, short tons	96,062	118,627	131,740	[3] 128,690	123,057
Exports, do	111,422	117,056	171,940	127,141	121,684
World production, do	136,000	154,000	168,000	161,000	160,000

[1] Excludes "All other manufactures of nickel," weight of which not recorded.
[2] Excludes "Manufactures," weight of which not recorded.
[3] Revised figure.
[4] Price quoted to United States buyers by International Nickel Co., Inc., for electrolytic nickel in carlots f. o. b. Port Colborne, Ontario; price includes duty of 2½ cents a pound, 1946–47, and 1½ cents, 1948–50

United States consumption of nickel in 1950 was a peacetime record and was 45 percent greater than in 1949. The 1951 demands of a dual-mobilization business-as-usual economy have been considerably more than the available supply could meet.

Nickel (Exclusive of Scrap) Consumed in the United States, 1946-50, by Uses, in Pounds of Nickel

Use	1946	1947	1948	1949	1950
Ferrous:					
Stainless steels	35,986,164	20,709,270	33,487,818	23,817,187	41,822,486
Other steels	31,193,988	34,758,973	43,264,600	36,948,418	35,854,167
Cast iron	5,973,919	7,005,576	8,431,667	6,792,672	9,761,622
Nonferrous [1]	51,819,728	54,747,667	56,087,738	37,942,540	56,277,053
High-temperature and electrical-resistance alloys	13,896,601	10,249,545	12,336,128	9,107,918	11,407,174
Electroplating:					
Anodes	17,699,306	17,975,335	28,425,717	27,630,786	34,847,691
Solutions [2]	866,916	1,218,208	1,327,306	1,448,584	1,481,215
Catalysts [2]	544,093	878,054	1,190,851	994,206	2,015,234
Ceramics [2]	287,635	385,113	370,708	388,248	704,766
Other	3,062,304	2,094,459	2,913,905	2,080,982	4,035,462
Total	160,210,774	161,513,859	187,116,518	136,952,228	197,807,690

[1] Comprises copper-nickel alloys, nickel-silver, brass, bronze, beryllium alloys, magnesium and aluminum alloys, Monel, Inconel, and malleable nickel.
[2] The figures for solutions and ceramics for 1946–50 and for catalysts for 1946–49 fall short of the totals.

Substantial increase in the use of high nickel alloys by the military services, such as in jet engines and atomic-energy products, has made it impossible to retain the 10-percent-defense, 90-percent-civilian economy insofar as nickel is concerned.

While the military demand[1] for nickel actually began in late 1950, the time lag between planning and production of military and atomic energy equipment delayed the impact of the acute shortage.

During the first quarter of 1951 the demand had grown to 40 percent of the available supply. This percentage grew to 50 percent in the second and third quarters and to 60 percent in the fourth quarter. It is estimated that the military requirements for the first quarter of 1952 will be about 75 percent of the available supply. While the available supply has increased only about 10 percent, the amount required by the military has doubled in little over a year.

Though the free world produced 10 percent more nickel in 1951 than it did in 1950, it appears doubtful that the United States received its proportionate increase during the fourth quarter of 1951. There seems to be little hope that this situation will change.

The *International Materials Conference* was formed among the countries outside the iron curtain at the

*Complete copies of this report may be obtained from The U. S. Gov't. Printing Office.

[1]*The figures listed here as military include that used for atomic energy projects.*

instigation of the United States, United Kingdom, and France. Realizing that many critical materials were in short supply, these countries were attempting to distribute basic materials equitably within the free world in accordance with defense and essential civilian needs.

Figures released by the International Materials Conference show that the United States was allocated 19,690 metric tons for the fourth quarter of 1951. This means that the conference allowed the United States to consume only 14,469,524⅔ pounds per month during the fourth quarter of 1951. The *National Production Authority* has been allocating nickel on a basis of at least 15,000,000 pounds per month since September of 1951.

The United States could probably get a larger percentage of the free world's nickel by bringing "dollar pressure" if it had not joined the conference. Assuming this to be true, it would hardly seem advisable not to join. There are many other facts to be taken into consideration. Our allies in the free world have to have the necessary nickel for their armament programs as well as that absolutely required by their basic economy. Maximum strength, and hence security, come from the underlying economic strength and morale of all the free world, not from one country alone. To sacrifice the economy and morale of other countries of the free world in order to supplement to a small degree our own economy and present armament program would hardly seem wise. There must be an equality of sacrifice in the free world's fight against communism.

Approximately 295,000,000 pounds of nickel were produced in the countries outside the iron curtain during 1951. This is an increase of more than 10 percent over 1950.

The International Nickel Co. of Canada, the world's largest producer of nickel, achieved an increase of 12,000,000 pounds annually during 1951. This company has been criticized for some of the practices it follows and for its failure to adequately expand. International Nickel Co. is prospecting for new nickel deposits in Canada, Africa, and elsewhere.

Canada's second largest producer of nickel, *Falconbridge Nickel Mines, Ltd.*, began an expansion program late in 1950 that is scheduled to increase their maximum production to a rate of 40,000,000 pounds annually. It will require a minimum of 3 years to raise ore production to this rate.

Sherritt Gordon Mines, Ltd., of Canada continued its program of exploration and development of nickel-copper ores in northern Manitoba and these mines are scheduled for initial production by the end of 1953. It is hoped that these mines can produce 17,000,000 pounds annually.

The United States Government-owned Nicaro nickel plant in Cuba is now in the process of being reopened and first production of this reactivated mine and plant is scheduled for early 1952. These facilities are expected to produce 32,000,000 pounds of nickel oxide annually. The closing of this plant in 1947 has been much debated and accusations have been made that the International Nickel Co. employed questionable pricing practices to assist in its closing.

The New Caledonia mines of *La Societe le Nickel of France* are being modernized and further developed. This should increase their production to 10,000 to 12,000 tons annually.

The National Lead Co. is hoping to produce a considerable amount of nickel within the next 5 years at its copper and separation plant at Fredericktown, Mo.

Reliable estimates of nickel production in the Soviet Union and satellite countries are not available, but trade sources believe that the free world's total is several times that of the countries behind the iron curtain. However, it should be pointed out that there is little doubt that the strides made by the Soviet Union since the 1930's have completely surpassed the increase in production by free world countries during the same period. One reason for this could be that approximately 85 percent of that produced in free world countries is produced by one company.

The National Production Authority has prohibited the use of nickel in the manufacture of many items. The list of items in which more than 6-percent-nickel alloys cannot be used fills nearly three pages. Nickel plating of many items has been completely prohibited.

Down-grading of the allowable nickel-alloy content has been required in nearly all items. The melt sheet listing the nickel alloy used must be submitted to Washington to be analyzed. The requested use of nickel can be denied, approved, down-graded in nickel content, or held up for more precise end-use information.

Recently the National Production Authority announced that further cuts in the allocations are a distinct possibility, stating that it may become necessary not only to extend the current list of prohibited uses further but also to reexamine the entire pattern of nickel allocations to effect further economies. It is reported that industry representatives advised the National Production Authority that most producers of stainless steel already are consuming minimum quantities of nickel and that any deeper cuts in nickel allotments for any group of producers will result in plant shut-downs.

American industry has been, as a matter of necessity, attempting to conserve nickel and substitute other products where possible. An increase in the use of copper for plating and a subsequent decrease and even omission of the use of nickel has become extensive. The thickness of the plate on automobile bumpers has been reduced drastically. One metallurgical expert said that 3 days at the seashore would likely leave the bumper on a new car looking like it had the chicken pox. Substitution of other metal finishes, such as zinc-tin, lead-tin, zinc-copper and silver have proven very popular. For interior decorating in automobiles and such, industry has been resorting to a die-cast alloy buffed to a high luster which is given a passivating treatment and covered with a coat of clear lacquer. It is likely that many of the 1952-model automobiles will use this for inside finish. The wartime procedure of resorting to organic finishes such as lacquers and enamels instead of nickel is becoming common.

The formation of the International Materials Conference was in part a conservation measure. Realizing the effect of critical material shortages upon the defense effort and basic economy of the free world, this conference has made determined efforts to conserve them as well as to see that they are equitably distrib-

uted. International allocation was directed toward conservation of nickel. Recommendations of the conference for the adoption of conservation measures and end-use controls have resulted in actions by governments which should do much to conserve nickel. The types of measures and degrees of control vary among countries according to the requirements of their economies. Recommendations on utilization of the available supply should make an important contribution to the efforts of industry to conserve materials.

It is too early to secure an adequate measure of the effectiveness of the allocations plans and recommendations of the International Materials Conference, but its very existence, as an effort of the countries of the free world to solve supply problems internationally, has had some steadying effect upon the general raw-materials situation.

Small-business concerns that depend upon nickel and nickel alloys, as well as larger businesses, have not been able to escape the dire circumstances brought about by the acute shortage of such a vital metal.

Many complaints and requests for assistance regarding nickel were made to your committee.

The demand for nickel from both the military and civilian consumers continued to grow. There was no substantial increase in the amount that was available. These circumstances gave birth to one of the most vicious gray markets that has ever been exposed in the United States.

The general existence of a gray market in scarce materials has long been a matter of common knowledge. The small-business man could understand why there was no nickel available from the established sources of supply—there simply was not enough nickel to go around, and the military and Atomic Energy projects rightly had first call on what was available. Sympathy and understanding of this condition began to wane when "brokers" offered "all of the nickel that you can use, at a price, of course."

Editor's Note:—The original report contains the details of the testimony brought out at the hearings in Washington on the ramifications and operations of the then-existant "gray" market in nickel. The "daisy-chain" operations, through which the price of nickel anodes got as high as $4.50 per lb. by passing through the hands of many unnecessary middle-men, are outlined. As an example of modern American business skullduggery and waste they would be hard to surpass, and are well worth reading about.

The attitude of the plating industry in general toward the gray marketeers in their field is adequately summed up in the following editorial which appeared in the October 1951 issue of *Metal Finishing*.

Black Nickel

In recent weeks the plating industry has undoubtedly obtained more publicity than ever before in its history. However, the odor created by it all is not exactly comparable to Chanel 5.

The recent inquiry by the Senate's Select Committee on Small Business into the black market existing in certain plating materials, principally nickel, has shown with convincing clarity how a small group of ruthless, unscrupulous chiselers can effectively victimize industry and thus endanger our national security.

We hope that those found guilty of violating the law will get the book thrown at them for their deeds, as well as providing a much-needed deterrent to others tempted by the lure of easy profit. Unfortunately, however, there will be a number of these shady characters who will escape their just deserts because there are too many loopholes in the present regulations governing transactions in these scarce materials. As a matter of fact, careful evaluation of the testimony brought out in the recent hearings reveals a surprising number of convenient loopholes in the regulations themselves as well as in the distribution system.

We sincerely hope that the splendid efforts of Senator Moody's committee in exposing this vicious racket will not go the way of the usual Senate investigations, and that prompt and effective measures will be taken to stamp out the operations of these traitorous leeches. A more direct and effective system of allocations for nickel and other scarce materials, especially to small users, certainly seems to be an immediate necessity.

The one bright spot in this whole odoriferous situation is provided by the courageous and patriotic action of a few men in the plating industry who helped to expose the whole mess, rather than go along dealing with the racketeers. The plating industry owes them at least a rising vote of thanks.

W. A. Raymond, *Editor*

While the demands of our industrial mobilization program have undeniably placed nickel in extremely short supply, and thus almost inevitably opened the door to abuses in its distribution, it is also an unquestionable fact that the fuzziness of OPS's price-control regulation has placed a welcome mat before those who have a mind to profit by circumventing Government price ceilings.

CPR 29 establishes a ceiling price on nickel scrap of 40½ cents per pound. To escape the application of this regulation, it is necesssary only to cast the scrap into anode form. It then is governed by Ceiling Price Regulation No. 30, which allows it to be sold at the highest price at which nickel anodes were sold by the particular dealer during the base period. It seems strange that nickel scrap in one form can be sold at no more than 40½ cents per pound, but if the form is changed it can then be sold at a legal price of $4.50 or more.

It is especially unfortunate, insofar as nickel is concerned, that the base period which determines the price was December 19, 1950, to January 25, 1951, inclusive. Nickel was in very short supply during this period and was then selling at premium prices. The effect of the general ceiling price regulation, in respect to nickel, was to legalize this premium price. However, the majority of the metal dealers were not content with the astronomical profits that could legally be made under these regulations. There was found to be general noncompliance with the existing OPS regulations in the nickel field. Many of the individuals and firms had not compiled a price chart, as they were required to do; many did not know what their ceiling price was, and some even said that the regulations were so complicated that they had made no attempt to interpret them.

The Office of Price Stabilization has been investigating the companies involved in this gray market for the last 4 months and is planning criminal prosecution in a number of the cases. OPS estimates that the investigation and public hearing of your committee uncovered approximately 50 companies that were in violation of their regulations and that a minimum of $150,000 will have to be returned to purchasers as civil damages. Penal damages are conservatively estimated at an additional $300,000.

Although over 4 months have passed since the loopholes in the Office of Price Stabilization regulations were exposed, no new regulations have appeared that deal with the situation.

Chemical Analysis and Control of Alkaline Metal Cleaners

By K. E. Langford, *Chief Chemist, Evered & Co., Ltd., Birmingham, England*

This article is reprinted by permission from the book "The Analysis of Electroplating and Related Solutions," published by Electroplating, 83/85 Udney Park Rd., Teddington, Middlesex, England.—*Ed.*

IN spite of their importance in the plating sequence, cleaners are not often given anything like the same degree of analytical control as plating solutions. To a large extent this is because their analysis is usually a somewhat difficult matter and, as they are relatively cheap, even many of the best electroplating shops prefer to replace them before their useful life has ended, while other shops wait until a batch of rejects shows that the life of the cleaner is over. In either case this is unsatisfactory and there is now a tendency, small but increasing, to attempt some measure of control of cleaners by determining certain chemical constituents and/or physical properties which can give some indication of the condition of the cleaner.

The difficulty of analyzing cleaners is due partly to the number of constituents which may be present and partly to difficulties resulting from the particular *combinations of materials* frequently found in proprietary cleaners; certain constituents are simple enough to determine when they are alone in solution, but when they are in admixture it may be impossible, or at least impracticable, to determine them individually. A report of Committee D 12 of the *American Society for Testing Materials* (ASTM Standards, 1945, part III, page 128) details at least 16 determinations in the analysis of industrial metal cleaning compositions such as may be used in the electroplating industry. Such detailed analysis is obviously intended for the identification or control of the solid mixtures.

Nevertheless, the author has proved over a number of years that effective cleaners need not contain more than two or three constituents, and that it is nearly always possible to choose these constituents so that the resulting mixture is not only effective as a cleaner but also is readily controlled by simple methods of analysis. It is perhaps rather unusual to formulate a solution on the basis of its ready analysis, but the author has proved that, in this case, it is both practicable and desirable.

The first part of this article is devoted to a discussion of such formulations and methods of analysis. It is followed by some easy control methods which can be used for other compositions and for proprietary cleaners of undisclosed composition.

Compounding of Cleaners

There is no known rapid, reliable test to indicate when the useful life of a cleaner is approaching its end. In many shops the "death" of the cleaner is first appreciated by a batch of stripped work which, on careful inspection, is found to be due to ineffective cleaning. If additions are then made to the tank, the trouble sometimes disappears, but more often the entire cleaner is discarded and made up afresh.

The procedure regarding maintenance of cleaners is entirely haphazard in most shops. In others, cleaners are changed more frequently than necessary to avoid reaching the stage at which trouble appears. The trouble is due more than anything else to the difficulty of analyzing cleaners containing certain chemical combinations. However, these combinations are seldom essential and it is quite possible by suitable choice of ingredients to prepare cleaners which are not only extremely effective but which are also amenable to rapid analysis by simple titration. Such cleaners can be controlled as easily as the plating baths themselves, and with equally satisfactory results.

This is not meant to suggest that all cleaning troubles are chemical. A cleaner in perfect chemical balance is useless if its surface is covered by a thick film of accumulated dirt and grease, since any work leaving it is generously smeared with it and stripping is a near certainty. Chemical control never was and never will be a substitute for "good housekeeping" in the plating shop.

What is suggested is that with chemical control and general shop cleanliness, cleaners of conventional types, based on a composition scheme to be discussed later, can be made to function for much longer than is generally realized.

Available Materials

Cleaning solutions must possess some or all of the following properties:

1. They must be able to saponify grease.
2. They must re-emulsify grease or oil which is unsaponifiable.
3. They must be peptizing agents.
4. They must be free rinsing.

Saponification is the splitting-up of fats (animal or vegetable) into their components. One component is a fatty acid (stearic, oleic, etc.), the other is glycerol (glycerine). Such fats, which are insoluble in water,

are saponified into the sodium salt of the fatty acid and glycerine, both of which are soluble and may be rinsed from the metal surface. The fatty acid sodium salts are soaps, and these may actually aid the action of the cleaner.

Oils of the mineral or lubricating variety cannot be saponified, being compounds of carbon and hydrogen only (hydrocarbons), and must be removed by the cleaner in the form of an emulsion, *i.e.*, a suspension of extremely minute droplets of oil interspersed with the aqueous medium. Wetting agents assist in the process by lowering the surface tension of the cleaner, enabling the oil to be more easily wetted and hence emulsified.

Peptization is the same property applied to solids. A good cleaner will remove solid buffing composition by dispersing it into minute particles which remain suspended in the cleaner. Wetting agents also assist here.

Free rinsing is obviously essential if the subsequent rinsing is to remove the cleaning solution entirely and leave no film on the work.

All the alkalis possess properties 1, 2 and 3 to some extent. Free rinsing is difficult with any alkali, but as there is no better material available, it has to be sacrificed for the primary considerations.

The common alkalis used in cleaners are as follows: caustic soda, sodium metasilicate, trisodium phosphate, sodium carbonate and sodium cyanide. Potassium salts are ignored as being too expensive and certainly no more effective. By hydrolysis all the above yield caustic soda to a greater or lesser extent:

$$Na_2SiO_3 + H_2O = 2NaOH + H_2SiO_3$$
$$Na_3PO_4 + H_2O = NaOH + Na_2HPO_4$$
$$Na_2CO_3 + H_2O = 2NaOH + H_2CO_3$$
$$NaCN + H_2O = NaOH + HCN$$

They will, therefore, behave in a somewhat similar manner to caustic soda, their properties being modified by the nature of acid radical which is also present. Caustic soda and sodium metasilicate are the strongest alkalis, having pH's of 12.7 and 11.9 even in 0.2% solutions. Trisodium phosphate and sodium carbonate come next with pH 11.7 and 11.2 respectively. Sodium cyanide is bottom of the list at pH 10.7. The first two alkalis are excellent saponifying agents and find use in hot cleaners where heavy grease is encountered. Trisodium phosphate is the best peptizing agent, though rather expensive. It is often replaced less satisfactorily by sodium carbonate (soda ash). Sodium cyanide has the invaluable property of dissolving metallic oxide films and finds great application in cold cleaners for non-ferrous metals, but being rather easily decomposed it is not often employed in hot solutions.

Many proprietary cleaners contain four of these alkalis and some contain all five, but no useful object appears to be served by employing more than two in hot cleaners or three in cold cleaners. Often only a few per cent is present in the mixture, making analysis difficult and adding no desirable properties to the cleaner.

Choice of Materials

By considering the chemical reactions of the alkalis when titrated with acid, they may be grouped so that mixtures of two or more can be compounded to possess desirable cleaning properties and, at the same time, be simple to analyze.

Consider the following equations, using hydrochloric acid for simplicity:

$$NaOH + HCl = NaCl + H_2O \quad (1)$$
$$Na_2SiO_3 + 2HCl = 2NaCl + SiO_2 + H_2O \quad (2)$$
$$Na_2CO_3 + 2HCl = 2NaCl + CO_2 + H_2O \quad (3)$$
$$Na_3PO_4 + HCl = Na_2HPO_4 + NaCl \quad (4)$$
$$Na_3PO_4 + 2HCl = NaH_2PO_4 + 2NaCl \quad (5)$$
$$NaCN + HCl = NaCl + HCN \quad (6)$$
$$NaH_2PO_4 + NaOH = Na_2HPO_4 + H_2O \quad (7)$$

By titrating any or all of the alkalis to a pH of 4.2 (methyl orange), reactions (1), (2), (3), (5) and (6) take place. By back titrating with caustic soda to a pH 8.6, reaction (7) is completed.

If, after titrating to pH 4.2, the solution is boiled, carbon dioxide and hydrogen cyanide are driven off, and silica is rendered insoluble. The phosphate can then be back titrated using N caustic soda to pH 8.6. Hence, trisodium phosphate can be determined in the presence of any other alkali. By titrating the cleaner with standard nickel sulphate as in the determination of cyanide in brass solutions (see later) sodium cyanide can be determined in presence of any or all the other alkalis. By selecting an indicator such as sulpho orange, caustic soda can be titrated in presence of sodium carbonate or sodium cyanide, but not in the presence of trisodium phosphate or sodium silicate. However, since trisodium phosphate is readily titrated by reactions (4) and (7), if one estimates the total alkali in a mixture of caustic soda and trisodium phosphate by titration to pH 4.2, then subtracts trisodium phosphate, the caustic soda remains.

By applying such a knowledge of their chemistry to combinations of the various alkalis it is possible to list certain combinations of alkalis which are tractable to analysis. Select the cleaner composition with this list at hand and the result is a simple, efficient, controllable cleaner.

The list used by the author is as follows:

Na_2SiO_3	/ $NaCN$	(Y)
Na_2SiO_3	/ Na_2CO_3	(N)
Na_2SiO_3	/ Na_3PO_4	(Y)
Na_2SiO_3	/ $NaOH$	(N)
$NaOH$	/ $NaCN$	(Y)
$NaOH$	/ Na_3PO_4	(Y)
$NaOH$	/ Na_2CO_3	(Y)
$NaCN$	/ Na_3PO_4	(Y)
$NaCN$	/ Na_2CO_3	(Y)
Na_3PO_4	/ Na_2CO_3	(Y)

Where the combination is followed by (Y) the analysis is easily possible. If followed by (N), analysis cannot be carried out by the methods outlined later in this article.

For three components, check all three combinations; if (Y) is indicated in each case, all three chemicals can be determined by the method given here. For example, can trisodium phosphate, sodium metasilicate and sodium cyanide in combination be readily checked by simple titration in a cleaner?

trisodium phosphate / sodium metasilicate	(Y)
trisodium phosphate / sodium cyanide	(Y)
sodium metasilicate / sodium cyanide	(Y)

Therefore the mixture is readily analyzed.

If No occurs in any of the combinations, simple titration will be impossible, although analysis by a skilled chemist may be quite possible.

The scheme breaks down if four alkalis are combined, but as mentioned before, this is neither necessary nor desirable, either from the aspect of efficiency or economy. Having prepared a method of alkali selection it remains to suggest which combinations are likely to be most effective in different circumstances and to suggest a simple analytical method for the determination of any three alkalies in a (Y) (Y) combination.

Cleaner Formulation

A good general purpose cleaner for use hot with or without current contains:

sodium metasilicate	6 oz./gal.
trisodium phosphate	6 oz./gal.
wetting agent	2 oz./gal.

The following is a heavy duty cleaner for iron and steel:

caustic soda	10 oz./gal.
trisodium phosphate	6 oz./gal.
wetting agent	2 oz./gal.

This cleaner is unsuitable for non-ferrous metals due to its high caustic soda content.

For a mild hot cleaner for non-ferrous metals, the hot general purpose cleaner used at half or two-thirds strength is very satisfactory.

For the cold electrolytic cleaning of brass and copper the following is suggested:

sodium metasilicate	6 oz./gal.
trisodium phosphate	10 oz./gal.
sodium cyanide	4 oz./gal.

A mild cathodic cleaner for aluminum and its alloys is made up from:

caustic soda	4 oz./gal.
sodium carbonate	4 oz./gal.

These examples of compounded cleaners which are capable of simple analysis are merely typical, the number of possible compositions and concentrations being very large.

It will be noticed that, in two instances, wetting agents are advocated, but this is entirely optional. It will be noticed that with one exception the use of soda ash is avoided, since in many instances this complicates the analysis. Naturally, in any cleaner containing caustic soda, carbonate will accumulate slowly due to carbon dioxide absorption but, by the time this reaches proportions large enough to interfere with the analysis, the cleaner will generally be due for renewal.

Analytical Methods

The following methods give results correct to ½ oz./gal., which is ample for cleaner control. Really accurate methods are quite possible to apply but are too time-consuming and cannot justify themselves for routine checks.

Mixtures of Trisodium Phosphate, Sodium Metasilicate, Sodium Cyanide

Take 10 ml. cleaner and titrate the cyanide using standard nickel sulphate solution (see below). Let this be C ml. nickel sulphate.

Take another 10 ml. sample and titrate with N sulphuric acid to a red color with methyl orange. Let this be A ml.

Boil off the hydrocyanic acid from this solution and continue boiling for five minutes to render the precipitated silica insoluble. Cool and add phenol-phthalein indicator. Titrate with N caustic soda to a faint pink shade. Let this be B ml. Then the cleaner composition is as follows:

$C \times 0.1 =$ oz./gal. sodium cyanide ($NaCN$)

$B \times 2.62 =$ oz./gal. trisodium phosphate (Na_3PO_4)

$(A - 2B - 0.127\,C) \times 1.70 =$ oz./gal. sodium metasilicate ($Na_2SiO_3 5H_2O$)

The first titration gives the sodium cyanide.

The second gives all the sodium metasilicate plus ⅔ the trisodium phosphate plus all the sodium cyanide. The third gives ⅓ the trisodium phosphate. Hence, each constituent can be determined.

If any component of the three is missing from the cleaner substitute zero for A, B, or C and the appropriate term will disappear in the calculation. Hence the one formula is applicable to any mixture of these three chemicals, any mixture of two or any one determined singly.

Nickel Sulfate Solution

Dissolve about 9.1 gm. of $NiSO_4 \cdot 7H_2O$ in 1 liter of distilled water. This solution is then adjusted so that 1 ml. is equivalent to 0.1 oz./gal. of NaCN, based on a 10 ml. sample. The standard sodium cyanide solution used for checking the nickel solution is standardized against 0.1 N Silver Nitrate solution.

Mixtures of Caustic Soda and Soda Ash

For the other recommended cleaner containing caustic soda and soda ash a slightly different approach is needed.

Take 10 ml. and titrate the caustic soda to sulpho orange using N sulphuric acid. The end point is when the indicator turns from a reddish-orange to a bright yellow. Let this be B ml.

Take a further 10 ml. and titrate with N sulphuric acid using methyl orange as indicator. The end point is when the indicator just becomes red. Let this be A ml.

Then:

$(A - B) \times 0.85 =$ oz./gal. soda ash

$B \times 0.64 =$ oz./gal. caustic soda

It must here be emphasized that sulpho orange cannot be used to titrate caustic soda in the presence of either sodium metasilicate or trisodium phosphate. In the first combination, analysis is only possible by estimating the silica using a tedious evaporation technique, hence it is labelled N on the list.

Mixtures of Caustic Soda and Trisodium Phosphate

The analysis of the second combination, of caustic soda and trisodium phosphate, must serve as the final example of this new conception of cleaner control.

Take 10 ml. and titrate with N sulphuric acid to the methyl orange, red end point. Let this be A ml. (This gives all the caustic soda plus two-thirds of the trisodium phosphate.) Boil off any carbon dioxide, cool the solution, and back titrate with N caustic soda using the pink end point of phenophthalein. Let this be B ml. Then:

$(A - 2B) \times 0.64 =$ oz./gal. caustic soda
$B \times 2.62 =$ oz./gal. trisodium phosphate

Had sodium cyanide been present also, the nickel sulphate titration would be C ml. and the final calculation thus:

$C \times 0.1 =$ oz./gal. sodium cyanide
$B \times 2.62 =$ oz./gal. trisodium phosphate
$(A - 2B - 0.127C) \times 0.64 =$ oz./gal. caustic soda

Mixtures of Sodium Cyanide and Caustic Soda

Take a 10 ml. sample, add 150 ml. water and titrate to the end point of sulpho orange using a cyanide solution to provide the color blank. Assume "A" ml. sulphuric acid are used. Take another 10 ml. and without dilution titrate with nickel sulphate to the first turbidity. Let this be "B" ml.

$A \times 0.64 =$ oz./gal. NaOH in cleaner
$B \times 0.1 =$ oz./gal. NaCN in cleaner

Mixtures of Sodium Cyanide and Sodium Carbonate

Take 10 ml., dilute to 150 ml. with water, and titrate the total alkali using methyl orange indicator, to the red end point. Take a separate 10 ml. and titrate with nickel sulphate as in above. Let the volume of N sulphuric acid be "A" ml. and the reading of the nickel sulphate be "B" ml.

Then:

$(A - 0.127B) \times 0.85 =$ oz./gal. Na_2CO_3 in cleaner
$B \times 0.1 =$ oz./gal. NaCN in cleaner

Mixtures of Sodium Carbonate and Tri-Sodium Phosphate

Take a 10 ml. sample, dilute to 150 ml. and titrate to the methyl orange end point with N sulphuric acid. Let this be "A" ml. Boil to remove any carbon dioxide, cool and back titrate with N caustic soda to the pink end point of phenolphthalein. Let this reading be "B" ml.

Then:

$(A - 2B) \times 0.85 =$ oz./gal. Na_2CO_3 in cleaner
$B \times 2.62 =$ oz./gal. Na_3PO_4 in cleaner

Mixtures of Caustic Soda, Tri-Sodium Phosphate and Soda Ash

This is certainly the most interesting case of all, due to the reasoning required to obtain the result.

Take a 10 ml. sample, dilute to 150 ml. and titrate to the red methyl orange end point. Let this reading of N sulphuric acid be "A" ml. Boil off all the carbon dioxide, cool, and back titrate with N caustic soda to the pink phenophthalein end point. Let this be "B" ml.

Finally, take another 10 ml., dilute as before and very carefully titrate with N sulphuric acid to the point at which the pink tint of phenolphthalein just disappears. The acid must be added very slowly with constant shaking to avoid local concentrations of acid with consequent loss of carbon dioxide. Let this reading be "C" ml.

Then it can be shown by simple algebra that:

$(A - B - C) \times 1.70 =$ oz./gal. Na_2CO_3 in cleaner
$(2C - A) \times 0.64 =$ oz./gal. NaOH in cleaner
$B \times 2.62 =$ oz./gal. Na_3PO_4 in cleaner

This method depends on a reaction which has not yet been mentioned, namely, the careful titration of a carbonate to the bicarbonate stage by N acid:

$$Na_2CO_3 + HCl = NaHCO_3 + NaCl$$

This titration is complete when the pink color of phenolphthalein just fades (See later remarks on the choice of more suitable indicators). Therefore, on titrating to the phenolphthalein end point, there is obtained:

$$\text{Total NaOH} + \tfrac{1}{3}\,Na_3PO_4 + \tfrac{1}{2}\,Na_2CO_3 = \text{"C" ml.}$$

The titration to the methyl orange end point gives:

$$\text{Total NaOH} + \tfrac{2}{3}\,Na_3PO_4 + \text{Total } Na_2CO_3 = \text{"A" ml.}$$

Finally, the back titration to phenolphthalein gives:

$$\tfrac{1}{3}\,Na_3PO_4 = \text{"B" ml.}$$

Let $X = NaOH$
$Y = Na_3PO_4$
$Z = Na_2CO_3$

Then:

$$A = X + \tfrac{2}{3}Y + Z \quad \ldots\ldots (1)$$
$$B = \tfrac{1}{3}\,Y \quad \ldots\ldots (2)$$
$$C = X + \tfrac{1}{3}\,Y + \tfrac{1}{2}\,Z \quad \ldots\ldots (3)$$

By substituting the value for B from (2) into (3):

$$(C - B) = X + \tfrac{1}{2}\,Z \quad \ldots\ldots (4)$$

and similarly substituting in (1):

$$(A - 2B) = X + Z \quad \ldots\ldots (5)$$

By subtracting (4) from (5):

$$(A - 2B) - (C - B) = \tfrac{1}{2}\,Z$$

which reduces to:

$$2(A - B - C) = Z$$

Substituting the above value for Z in (5):

$$(A - 2B) - 2(A - B - C) = X$$
$$(2C - A) = X$$
$$3B = Y$$

Note on the Choice of Indicators

All the methods given previously can be relied upon to give results correct to within ¼ or, at the very worst, ½ oz./gal. This is sufficiently accurate for all control purposes but, by using more sensitive indicators, it is possible to obtain a higher degree of accuracy. The

following suggestions are due to *A. I. Vogel* (Quantitative Inorganic Analysis, pp. 295-305. Longmans, Green & Co., 1942).

For titrating sodium carbonate use methyl orange, bromcresol green or a mixed indicator consisting of 1 gm./l. methyl orange and 2.5 gm./l. indigo-carmine. The colors given by the mixture are, yellowish-green when alkaline, green at a pH of 4.0, and violet when more acid.

For titrating carbonates to the bicarbonate stage, a mixture is recommended of cresol red 1 part and thymol blue 6 parts. This is violet at pH 8.4, blue at 8.3, and rose at 8.2.

For the first stage of the neutralization of phosphoric acid, the methyl orange/indigo-carmine (pH 3.1 to 4.4) is advised, also bromocresol green (pH 3.8 to 5.4), while for the second stage, a mixture of phenolphthalein 2 parts, and *a*-naphtholphthalein 1 part, is used. This changes from pale rose through green to violet at a pH of 9.6. Another suggestion is the use of a blank solution of the particular phosphate to which the unknown is being titrated, *i.e.*, for the first stage, use a solution of sodium di-hydrogen phosphate plus a little indicator, while for the second stage use sodium monohydrogen phosphate. The unknown is then titrated to the same color as the blank.

ACID/ALKALI EQUIVALENTS

1 ml. N H_2SO_4 = 0.0400 gm. NaOH
= 0.0530 " Na_2CO_3
= 0.1640 " Na_3PO_4 (to pH 9.7)
= 0.0820 " Na_2HPO_4 (to pH 4.6)
= 0.0602 " Na_2SiO_3
= 0.1061 " $Na_2SiO_3 \cdot 5H_2O$ (METSO)

Silica Present as Soluble Silicate

Method to be Used when Simple Titration is Inadmissable due to Interference from Another Alkali

Transfer a 10 ml. sample of the cleaner to a 100 ml. porcelain evaporating dish. Add sufficient hydrochloric acid to render the liquid acid to litmus, then a further 20 ml. in excess. Evaporate down to dryness on a water bath, then very carefully, avoiding spitting, bake on a hot plate for at least 1 hour. Cool, replace on the water bath, add 25 ml. concentrated hydrochloric acid, and digest for 5 minutes. Dilute with water to dissolve sodium chloride and raise to a boil on the hot plate. Filter off through a No. 40 Whatman paper, policing out the dish thoroughly, and washing well both the silica and the dish with hot water. Dry the paper carefully, then burn off over a very hot flame, cool in a dessicator, and weigh as silica.

$$SiO_2 \times 3.531 = Na_2SiO_3 \cdot 5H_2O$$

Gm. SiO_2 found $\times$ 56.50 = oz./gal. $Na_2SiO_3 \cdot 5H_2O$ in cleaner.

Soluble silicates are, by evaporation with hydrochloric acid, converted into hydrated silica and the salt of the acid used.

$$Na_2SiO_3 + 2HCl = H_2SiO_3 + 2NaCl$$

The hydrated silica or silicic acid is de-hydrated and rendered insoluble by baking. Being a very refractory material, it can safely be burnt off in a crucible.

$$H_2SiO_3 + = H_2O + SiO_2$$

The use of 70% perchloric acid is now recommended for the de-hydration of silica, and it is more rapid since it is only necessary to evaporate down to fuming to render the silica insoluble. ***Its use is not advised if wetting agents or other organic materials are present in the cleaner; under such conditions an explosion may result.***

Cleaners of Unknown Composition

QUALITATIVE ANALYSIS

As already explained, the above methods are only suitable for certain combinations of constituents. They cannot, therefore, be applied without discrimination to any proprietary cleaner with which the analyst is confronted, since he will normally have no indication as to whether the combination of chemicals used therein is such as can be dealt with by the methods given. It would, therefore, seem desirable to include a series of simple qualitative tests to enable the chemist to ascertain the composition of his cleaner but, although this may appear to be comparatively simple, it is not practicable. In many cases the only way to determine the chemical composition of a cleaner is to carry out a complete quantitative analysis, which is usually a very involved procedure.

Suppose for example a cleaner consists of caustic soda, sodium metasilicate, soda ash and tri-sodium phosphate: such a mixture is actually on the market. It is comparatively simple to carry out a qualitative test for phosphate, and not difficult to prove the presence of carbonates; silicates are readily detected if the cleaner is new, otherwise it is much more difficult.

There is no means of indicating the presence of caustic soda since both sodium metasilicate and tri-sodium phosphate hydrolyze in solution and behave, to indicators such as Tropaeolin O and sulpho-orange, as solutions of caustic soda and would be partially titrated under these circumstances. From the appearance of the salts and the extent to which they are hygroscopic, the presence of caustic alkali can sometimes be inferred; the "feel" of the moistened material and the heat generated on solution in water are also indicative of caustic soda. However, what on these grounds appears to be caustic soda may actually be sodium orthosilicate or one of the other commercial silicates possessing a high Na_2O/SiO_2 ratio.

Similarly the detection of carbonate does not necessarily imply the presence of soda ash in the original salts, since both tri-sodium phosphate and caustic soda adsorb carbon dioxide from the atmosphere producing some carbonate. Any cleaner containing sodium cyanide will likewise be certain to give a positive reaction for carbonate, owing to the ease with which carbon dioxide decomposes this salt. If phosphate is detected in a cleaner it may have originally been added as any of the sodium orthophosphates, sodium hexametaphosphate, sodium pyrophosphate or possibly sodium tripolyphosphate. Although any of these salts could be identified if present in the pure form and not in admixture, all will be readily hydrolyzed to orthophosphate during the performance of the test for phosphate.

It is sometimes only possible to identify the more complex phosphates in mixtures, by fractional crystallization and microscopic examination of crystal form. Similar reasoning applies to sodium sesqui-carbonate sometimes used in place of soda ash.

If resin soaps or wetting agents are added to the mixture, even more complications are introduced, and analysis is literally impossible.

In the case of sodium silicate, it is fairly easy to identify this salt by precipitation of hydrated silica under suitable conditions, but if the cleaner has been used on aluminum articles, sodium aluminate will be present and aluminum hydroxide will also come down. This latter substance, at least to the inexperienced, appears to be identical with silica. This adds another complication to an already formidable array.

To analyze a cleaner of the composition mentioned earlier, it would first be necessary to carry out a titration for total alkali expressed as Na_2O, and then to perform a gravimetric determination of silica. The carbonate would then be determined, probably by the laborious method entailing the absorption of evolved carbon dioxide in "U" tubes packed with soda lime. Each detected anion would then be calculated to the sodium salt and any excess Na_2O over and above that required to satisfy the anions would be calculated to caustic soda, if the latter was suspected to be present. The determined percentages of the constituents rarely add up to exactly one hundred per cent, since the degree of hydration of the salts is rarely that required by theory from their formulae. To attempt to determine water present is exceedingly difficult in the presence of caustic alkali.

It was precisely to avoid these involved procedures that the scheme of selected controllable cleaners was introduced, but for those who wish to go further into the matter, the following qualitative tests for carbonate, silicate, phosphate and cyanide will be found useful. These must only be applied after careful consideration of all the facts outlined above, and with a very open mind regarding their subsequent interpretation. In all possible cases they should be carried out on the fresh salts from which the cleaning solution is prepared, and never on a used bath.

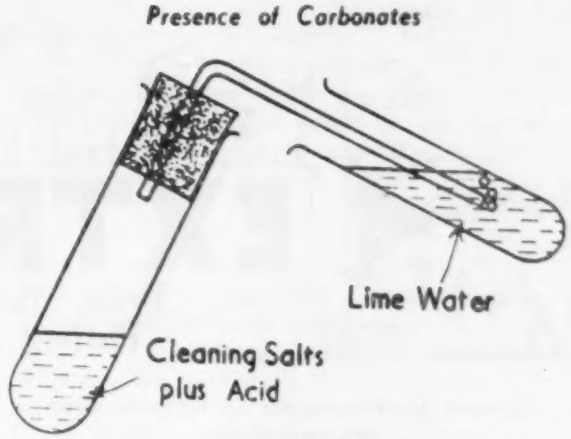
Presence of Carbonates

Fit up the simple apparatus shown in the sketch. It consists of a large test tube fitted with a bored cork and a right-angled delivery tube. In the second smaller tube is a solution of lime-water (made by shaking pure slaked lime with distilled water and filtering). Place about 3 gm. of the cleaner salts into a large test tube and quickly add excess 50% hydrochloric or nitric acid, immediately replacing the cork and dipping the end of the delivery tube beneath the lime-water. Allow the liberated gas to bubble through the latter. A white precipitate in the smaller tube indicates the presence of carbonate in the salts. On continuing the passage of the gas, the precipitate may redissolve due to the formation of calcium bicarbonate, but reappears on boiling when the excess carbon dioxide is driven off.

$$Na_2CO_3 + 2HCl = 2NaCl + H_2O + CO_2$$

$$CO_2 + Ca(OH)_2 = CaCO_3 \downarrow + H_2O$$

$$CaCO_3 + CO_2 + H_2O \rightleftharpoons Ca(H\,CO_3)_2$$



CARBONATE DETECTION

Presence of Silicate

About 1 gm. of the cleaning salts is dissolved in 10 ml. of water and faintly acidified with hydrochloric acid. 3 gm. of ammonium chloride is then added, followed by enough ammonia to render the liquid distinctly alkaline. A white gelatinous precipitate which readily clings to the sides of the tube is indicative of silicates. It is essential to have a fair concentration of a strong electrolyte (ammonium chloride) present in order to prevent the formation of colloidal silica, in which case it may remain wholly in solution.

Presence of Phosphate

Boil about 1 gm. of the salts with 10 ml. concentrated nitric acid in a small beaker. Filter off any precipitated silica and collect the filtrate in a large boiling tube. Add 3 gm. ammonium nitrate and 5-10 ml. of ammonium molybdate solution (freshly prepared). Finally add a further 5 ml. of concentrated nitric acid and place the tube in a beaker of boiling water. Heat tubes for 5 minutes, occasionally mixing the contents of the tube. The appearance of a bright yellow precipitate of ammonium phosphomolybdate indicates the presence of phosphates. Any white molybdic acid which sometimes separates should be ignored. Do not boil the solution.

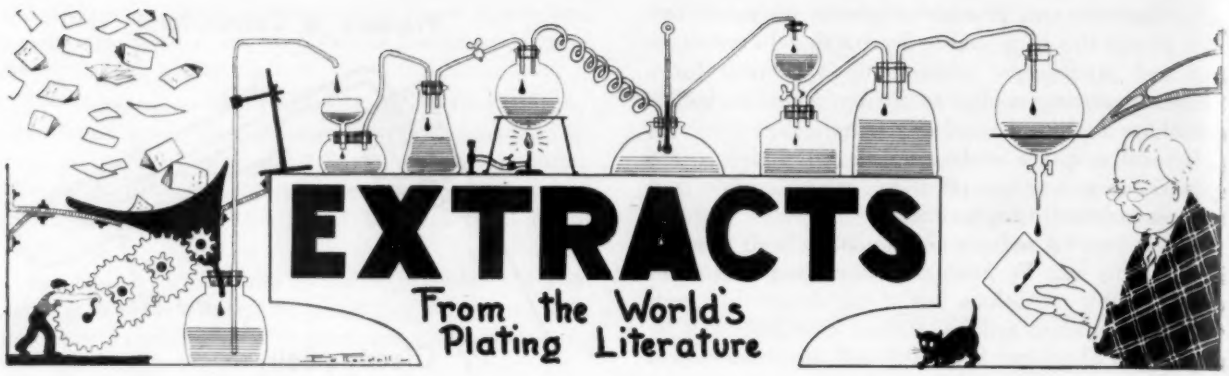
Presence of Cyanides

About 1 gm. of the salts is placed in a test tube and acidified with 10 ml. of 50% hydrochloric acid. If cyanide is present hydrocyanic acid gas is liberated and is readily detected by its characteristic odor (*Caution!*). To confirm its presence when mixed with carbon dioxide, pass the gas into dilute caustic soda solution in the apparatus given under carbonates. Boil the solution of sodium cyanide obtained, with a few drops of ferrous sulphate solution. Now faintly acidify with hydrochloric acid and gently beat. A precipitate of prussian blue confirms the presence of cyanides.

Quantitative Methods for Other Combinations

For cleaning combinations which cannot be controlled by the methods outlined above, the following procedures for total alkali, sodium cyanide and phos-

(*Concluded on page* 74)



Recent Developments in Cyanide Zinc Plating Baths

E. W. Dettner; *Metalloberflaeche;* vol. 3, No. 10, pp. B145-B147.

Of paramount importance in the operation of a cyanide zinc bath is the M-ratio, i.e. the ratio between the metallic zinc and the total cyanide content. For zinc baths this should be 1:2 and for bright zinc baths about 1:2.75. For still baths the M-ratio should amount to 2-3 and for agitated baths 2.5-3.2. This factor is dependent on the temperature, i.e. for higher temperatures it must be greater and for lower temperatures it should be smaller. With a low M-ratio, the current density can be high; with an increasing M-ratio the separating region for bright deposits is reduced. Although it is accepted that the caustic soda concentration is of less significance than the M-ratio, a minimum concentration must be present. In cyanide zinc baths this should be 60 grms./litre; for still bright baths 75-112 grms./litre and for barrel plating baths 75-97 grms./litre.

The zinc deposit is improved with a not too high concentration of caustic soda while an excessive amount leads to irregular anode solubility and causes increased hydrogen absorption in the deposit as does too high a zinc cyanide content. This disadvantage can be partially countered by increasing the bath temperature and current density.

After discussing the effect of addition agents to zinc cyanide baths, the author considers bright zinc bath formulations. As brightener additions a great number of organic and inorganic additions have been proposed. In modern baths, organic addition agents bind the greatest application as brighteners. The aromatic aldehydes such as benzaldehyde, anisaldehyde, vauillin and piperonal (heliotropin) are the organic additions favored. Other organic addition agents for the bright zinc bath are condensed oxy-heterocyclic compounds with a benzene ring nucelus, cumarine safrol, naphthal inedispulhonic acid, phenylenediamine, thiourea, gelatine, gum arabic, glucose, dextrine, furfurol. With the addition of organic brightening agents the anodes sometimes tend to strong polarization. Zinc anodes alloyed with magnesium, calcium or magnesium,calsium have been used for bright zinc baths. Bath cleanliness is most important with bright zinc plating. Foreign metals such as particularly copper, tin and lead reduce the hydrogen overvoltage on the zinc so that this leads to the deposition of spongy, dark deposits. Foreign metals may be removed from the bath by electrolysis at low current density or better by adding to the bath zinc dust, sodium sulfide, sodium bisulfite, sodium thiosulfate, phenylhydrazine, formaldehyde, etc. If bath filtration is provided, then regular additions of sodium sulfide may be made to the bath. As zinc coatings easily discolor care must be taken to keep the rinse water scrupulously clean. With bath filtration, activated carbon should not be used as the filter medium as the brightening addition agents will also be retained on the filter; kiselguhr will dissolve in the alkaline bath and is unsuitable; nylon has been recommended as the filter medium.

The pH value with zinc cyanide baths should amount to 13.5. Over 13.5 the deposit easily becomes dark colored and with low pH values the anode solubility suffers.

Electropolishing of Nickel and Nickel Alloys

Technische Rundschau, 1951, No. 14.

The following electrolyte is recommended for the electropolishing of nickel and corrosion-resistant nickel alloys. The electropolishing solution composition is: 46 to 85% phosphoric acid; 1 to 29% chromic acid; 13 to 34% water. The bath temperature is given as 31 to 45°C., the current density as 12 to 25 amps./sq.dm. and the time of treatment from 4 to 12 minutes. Instead of chromic acid, equivalent amounts of chromate or bichromate can be used and instead of orthophosphoric acid, meta or pyrophosphoric acid can be used.

Pickling Accelerators

Rossi-Landi; *La Metallurgie* vol. 83, No. 9, pp. 687-689.

To understand fully the mechanism and function of pickling inhibitors it is first necessary to study the actual course of the reaction during the pickling of ferrous metals. The acid first slowly ocmmences its attack, penetrates through the parts least covered with the exterior scale, makes contact with the wustite rich in iron and more or less porous and the reaction commences; the wustite produces the first atoms of hydrogen and the metallic surface is uncovered little by little. The acid attack becomes more violent and the hydrogen is produced in quantity and breaks away the scale more or less violently by mechanical shocks.

A technical disadvantage of pickling inhibitors is

that the pickling procedure is slowed down by their use. It is accordingly necessary to find means by which the pickling is not slowed down while using inhibitors in the bath. The reactions acid/iron, giving rise to the formation of hydrogen and of ferric salts can be activated by the addition to the bath of a certain quantity of these same salts. In thus speeding up the initial reaction, the solution of the wustite is facilitated and as a consequence the infiltration of the acid through the scale and the hydrogen generation by the acid attack on the metal.

By utilizing in combination the two pickling products of accelerators and inhibitors the net sum total of a double reaction is obtained: the accelerator acts as a positive catalyst and the pickling inhibitor as a negative catalyst. The first activates the attack of the acid which is indispensable to the de-scaling process, and the second arrests the attack of the acid by combination with naiscant hydrogen as soon as the metal is bared. The accelerators play in addition a further role. They do not act only at the first stage of the de-scaling by correcting the slowing down caused by the presence of the inhibitor but in addition they prove extremely effective in renewing the force of the acid in an exhausted bath, and in this manner.

During the pickling, the metals in an acid medium produce ferric salts and these remain for a long time in suspension before being deposited at the bottom of the bath. The presence of these salts retards considerably the course of the pickling and causes a blackish deposit on the pickled metal difficult to remove. If however a determined quantity of the same salt is added to a pickling vat charged with ferric salts, by an ionization phenomenon of the aqueous mass there is caused a sensible diminution of the static resistance of the salts produced.

Modern Vacuum Surface Coating Processes

Feinwerktechnik; No. 54, pp. 243-45.

The manufacture of very thin applied coatings of either an electrically conducting or insulating nature for such purposes as anti-reflex coatings on photo lens, mirror surfaces, filter coatings, special directive surfaces for electrical rectifiers, photocells, protective surfaces for corrosion of wear and for ornamental and decorative purposes is being obtained to an increasing extent by volatilization or cathode sputtering processes. The coating thickness amounts on the average to 0.5 mu; the tolerance is a few millimicrons.

This tolerance is accordingly about 1/1000 times smaller than is the case with mechanical working by grinding, honing, lapping. As a consequence of the small thickness of the applied coatings the structure of the surfaces does not change; on polished surfaces a mirrored coating is formed while matt surfaces remain matt. The coating process is easily conducted by volatilization or cathode sputtering as a consequence of the expansion of the atoms and molecules in the high vacuum leading to the emission of ions and electrons. The coating material is heated electrically in addition so that it becomes capable of emission. Because absorbed foreign coatings of gases and vapors are not present on the receiving surface and because of the vacuum, the emitted coating ions pass easily over to the surface to be coated and then become keyed to this surface with molecular force.

Instead of thermal evaporation, a glow electrode is used for cathode sputtering. The high vacuum pump equipment and electrical equipment together with the control and supervisory instruments are housed together centrally in a pulpit. Silver, aluminum and their alloys are suitable for mirror coatings on account of their high reflective capacity and also rhodium, gold and magnesium alloys and for such purposes as headlamp reflectors. A deposited aluminum coating with an additional protective deposited quartz coating has a reflective capacity in daylight of about 90% and maintains this up to about 400°C. and is proof against wiping, corrosion and sea water. Heat filters and antidazzle protective coatings as well as light filters can also be economically produced by this process.

The Passivation of Tinplate

W. Eilender; *Werkstoffe und Korrosion;* vol. 2, No. 8, pp. 289-292.

Passivation coatings are a branch of chemical protective coating processes in the same way as phosphatizing and black oxide coatings are, as well as lacquer coating. In its fundamentals the passivation process consists of a chemical processing of the sheet surface so as to afford protection against corrosive attack and is intended as the ultimate result to increase the useful service life of the sheet so handled. Its protective effect is applied with particular advantage where the durability of bimetallic combinations as for example with the combined assemblage working of iron and brass sheets or iron and aluminum sheets is practiced, i.e. at those places where the danger of destruction by element formation (local cell attack) is particularly great. In the case of sheets which already possess a coating of a corrosion resistant metal such as nickel, copper, tin etc. with a suitable passivation treatment the spread of any locally corroded spot is presented and the attack of aggressive medii, particularly by sulfides or organic acids, is reduced.

Chromates and phosphates are important members of that group of solutions which possess passivating properties. In the case of chromates it is the hexavalent chromium compounds, to which the chromates, bichromates and chromic acids belong. Consequently the content of the passivating solution in hexavalent chromium ions is important and the pH value should lie between 7.5 and 9.5. The protective effect obtained is afforded by an electrochemical process what is termed anodic polarization. There is first formed a protective oxygen film on the metal surface, and this after further action is strengthened by a metal oxide film. It is feasible that these very thin invisible films possess only molecular coating thickness because up to now it has not been possible to isolate them for the purpose of chemical examination.

The author examined the passivating properties of various solutions for a passivating treatment of sheet surfaces and an investigation was made of the effect of concentration, temperature, treatment time, and various additions. Tinned steel sheet was used as the sheet material as this is the material for the containers for the food packing industries. In consideration of the fact that in use these sheets are frequently exposed

to a strongly corroding sulfur attack by foodstuffs and further during the stoving of lacquers can discoler, tinplate sheet accordingly is an excellent test medium. In addition it was possible to ascertain the porosity and this is a criterion of regarding the protective effect of a coating.

For the passivating solutions, there was used potassium permanganate and potassium bichromate in strength of 0.1 to 5% solution. As the potassium permanganate solutions have a relatively good wetting power and therefore give a uniform effect on the sheet surface they were used without any special additions. The pure chromate solutions on the other hand only wet the surface slightly so that here wetting agent additions had to be added.

All sheets tested were degreased before the passivation treatment. It had been ascertained from preliminary tests that a passivation treatment time of 30 seconds was sufficient. The passivation temperature was about 80° C. and it was found that all the solutions at room temp. had slight or no inhibitive effect.

To test the protective effect obtained with the passivated sheets they were exposed to corrosive attack of a sulfur containing solution. A test solution of yellow ammonium sulfide proved unsuitable as the attack was too strong. It was decided to test the passivated sheets in an aqueous solution of hydrogen sulfide at 60° C.

It was found from the test phenomena that the sulfur attack frequently starts by way of small pores at which iron sulfide is formed by way of the exposed iron. This then precipitates on the surface and causes an attack of the tin coating. For purpose of comparative test, with the passivated test sheets, an untreated sheet was tested at the same time.

It was found that all the passivated sheet behaved better as regards sulfur attack than the untreated sheet. The chromate passivating solution with an organic wetting agent gave particularly good results. The sheet in this case remained white and bright; on the other hand the other sheets tended to discolor but none so strongly as did the untreated sheet. It was found that the passivating chromate solutions were effective in a broad range of concentration. The porosity tests were conducted by the normal potassium ferricyanide test. It was found that in most cases the sheet which withstood the corrosion test in the hydrogen sulfide, also showed the lowest porosity number.

Finally to summarize the results obtained, during the course of this research to ascertain the applicability of various solutions for a passivation treatment of tinplate sheet as a protection against sulfur attack such as is frequently occasioned by foodstuffs as well as to give a degree of protection against atmospheric corrosion, both hot dip tinplate and electroplated tin sheet were examined. It was found that with the chromate solutions a favorable effect could only be obtained by the addition of wetting agents. The sheets treated with these passivating solutions withstood attack lasting many hours by a hot aqueous solution of hydrogen sulfide without discoloring and without showing any etcihng attack spreading from the pores. Heating of the passivated sheet to temperatures up to 200° C. could be conducted without danger of oxidation and discoloration.

CHEMICAL ANALYSIS AND CONTROL OF ALKALINE METAL CLEANERS

(*Concluded from page* 71)

phate will be found useful for control purposes, although it must be realized that they have very definite limitations.

For hot cleaners containing any or all of the following chemicals NaOH, Na_2SiO_3, Na_2CO_3 and Na_3PO_4, a titration for "alkalinity" can be carried out. By titrating with N HCl or H_2SO_4 to the methyl orange end point, a figure is obtained which is a measure of the alkaline strength of the cleaner. It will include the total NaOH, Na_2CO_3 and Na_2SiO_3 and $\frac{2}{3}$ Na_3PO_4. It is usually calculated as total Na_2O or merely left as a titration figure. No indication is given of the composition of the cleaner since any NaOH originally present may have been entirely converted to Na_2CO_3 by the CO_2 of the atmosphere. Some Na_3PO_4 may likewise be affected. The figure will be most reliable for cleaners containing no NaOH, in which case salts (in their originol proportions) can be added to restore the bath to its original strength. In order to do this it is necessary to know the "titration number" or Na_2O content of the freshly made cleaner. This may readily be found by titrating a newly prepared bath as follows:

Pipette a 25 ml. sample into a conical flask and dilute to 150 ml. with water, adding 3 drops of methyl orange indicator. Titrate with N HCl or H_2SO_4 to the orange-red end point.

1 ml. N HCl = 0.03100 gm. Na_2O
Mls. N HCl used × 0.1984 = oz./gal. Na_2O in bath
Mls. N HCl used × 1.2400 = gm./l. Na_2O in bath

For cold cleaners containing NaCN, the latter can be titrated using the standard $NiSO_4$. Knowing the percentage of NaCN in the original cleaner, it is then possible to make additions in the original proportions. The danger inherent in this artifice is that since NaCN decomposes rather readily, the addition of mixed salts on the sole basis of cyanide analysis results in the build up of the other constituents in unbalanced proportions. If this method is used it should be applied in conjunction with a density determination (Tw. or Bé.) which will give a very good indication of the total concentration of salts in the bath. When the density is correct, NaCN only is to be added, but when both NaCN and density are low, add mixed salts in the original proportions.

It is also possible to determine the total Na_2O (equivalent) in a cold cleaner containing NaCN by titrating with acid as described above, thus arriving at a titration figure. In addition to titrating the constituents referred to previously, the whole of the NaCN will also be included.

If soluble soaps are present in cleaners, the fatty acids will be liberated on titration with HCl, so that they are included in the Na_2O determination. Some wetting agents (the anionic type) will also be included.

Complex phosphates such as hexametaphosphate, sodium pyrophosphate and the newly developed sodium tripolyphosphate, if added to cleaners, will fairly rapidly hydrolyze to the more stable sodium orthophosphate, which will be two-thirds titrated as explained above.

Outstanding Ladies Program Planned For Chicago Convention

June 16-19 – Conrad Hilton Hotel

A.E.S. ladies will have a double incentive for inducing their men to bring them to the Chicago Convention this year. *Mrs. Marion Longfield*, ladies' chairman, and her committee have not only arranged a program of unusual interest, but have added a new feature this year that will undoubtedly be adopted as a permanent and featured attraction at future conventions.

During the opening session, which the ladies are to attend with the men, one of their number will be chosen as "Convention Queen" to serve as First Lady of the Convention at all functions in which the ladies participate. All of the ladies have an equal chance to win this coveted honor. A card will be deposited for each lady as she registers. From these will be drawn three cards; the first drawn will be for the queen, the second and third will be for her attendants. There are only two limitations in this contest: the lady chosen as Queen must be over 16, and she must be present at the time of the drawing.

Choosing a few from among Chicago's many famous attractions is always a difficult task, but the places and their locations where the ladies will be entertained have been wise choices. Their program will include a Tea in the Narcissus Room at famous *Marshall Field & Company*, where the high point of the afternoon will be a style show, a subject close to every woman's heart. Here the latest creations in dresses, hats, coats and accessories will be modelled under the capable direction of Field's famous stylist.

The International Fellowship Open House party in the Grand Ballroom of the Hilton Hotel, where the ladies will join the men for an evening of fun and frolic, will be especially looked forward to as the time when the "Queen of the Convention" will be crowned and honored.

Ladies Chairman

Mrs. Marion Longfield

Dave Clarin will again preside as host and only man at the Aunt Ella Society garden party-luncheon to be served in the McKinlock Memorial Court of the Art Institute of Chicago. This charming garden, overlooking the Carl Milles Fountain of the Tritons, is a favorite sketching spot for the students of the Institute and will be a delightful spot for the visitors to escape the bustle of a busy city. Following the luncheon the program will move indoors to Fullerton Hall, where they will be entertained by a talk on the furniture, china and other magnificent works of art exhibited at the Institute. At the close of the lecture the ladies will be free to visit the galleries and view both the permanent and current exhibits of the Museum at their leisure. Since the Art Institute houses so many of the world's most famous treasures of Art, this should prove a pleasurable and educational afternoon.

Each year everyone looks forward to the fun of a Plato party. *Mrs. Joan Wiarda*, hostess, promises that this year she is making great plans for a grand, rewarding affair. Entertainment at a luncheon in the famous Boulevard Room of the Conrad Hilton Hotel by *Sulie Harand*, monologist, will also be a high point in the program, as she is noted for the wit and vivacity of her impressions. All this, plus a final visit to the International Amphitheater where the ladies will view the exhibits at the Industrial Finishing Exposition and hear a talk by a noted authority on custome jewelry and/or kitchenware, will be climaxed by the Annual Banquet and Ball on Thursday night.

In her few hours of free time, Mrs. A.E.S. may want to visit some of the other points of interest in Chicago or attend current radio or television performances at Chicago broadcasting studios. Tickets for such programs as "*The Breakfast Club*," "*Welcome Travelers*," etc., will be available for those who want them. The North Assembly Room in the Conrad Hilton Hotel will serve the ladies as an information center, meeting room and a place of gathering to leave for all functions.

With all these fine things in view for Mr. & Mrs. A.E.S. many families will plan their vacations around a trip to Chicago in '52. Plans are being completed for taking care of a record crowd. The housing committee has obtained blocks of rooms in leading Chicago hotels among which are 900 rooms in the Conrad Hilton Hotel.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Blue Dip for Silver Plating

Question: Will you kindly send me any available information relative to the so-called "blue dip solution" for silver plating without the use of a strike bath?

Z. F. E.

Answer: The "blue dip," or "quicking bath" is made up of

1 oz./gal. Mercuric chloride
½ " Ammonium chloride

This solution should not be used on cold-worked brass, due to the danger of cracking the brass. It is sometimes used on copper and nickel silver parts, but in recent years has almost entirely disappeared because of the above trouble.

Hardness of Plated Silver

Question: In silver plating to a thickness of .001-.002" we get a hardness reading of 95-105 Vickers. Can you tell us of this hardness would be considered normal? Can any harder deposit be obtained without alloying the silver deposit?

F. W.

Answer: With deposits this thin it is difficult to judge whether or not the hardness figures you report are truly indicative of the hardness of the silver itself or affected by the base metal, without knowing the exact method and loads used in your hardness testing.

The only figures we have on the hardness of silver deposits are for much heavier deposits, in the range of .030-.040". These hardnesses range from Rockwell E 90-100. When such silver deposits are annealed this hardness will drop to about Rockwell E 40-44. Another authority reports silver plating hardness of 100-120 Vickers, using a 5 Kg. load on the diamond. Here again the thickness of the deposit was much heavier than yours, and heavy enough so that the base metal did not affect the results.

Copper as a Carburizing Stop-Off

Question: Can you give us any information on the relative merits of cyanide and acid copper deposits as a stop-off medium for carburizing operations? We are particularly interested in deposits from the rochelle type cyanide bath.

S. W. R.

Answer: The effectiveness of copper plating as a stop-off for carburizing depends on its being free of pores and thick enough to provide a barrier to the carburizing medium. Therefore, as long as the copper deposit is dense equal thicknesses from either type of plating bath should be equally effective. It is generally agreed that it is easier to obtain more dense deposits from the cyanide type bath, especially if it is used with periodic reverse current. In addition, it is necessary to put the preliminary strike on the steel from a cyanide bath, so as to prevent an immersion film, although there is no reason why the bulk of the deposit cannot be made from the acid bath. Acid type deposits in the range of .001-.002" have a tendency to be tree-like in structure, which would be expected to have greater porosity than cyanide deposits. For all these reasons the cyanide bath is the one most widely used for stop-off plating.

Cadmium-Bearing Copper for Copper Plating

Question: The shortage of copper has made it necessary to use every means at our disposal to utilize all possible types of copper scrap, etc. as anode material. Recently we ran across some trolley wire containing .9% of cadmium, balance copper, and we are wondering if there is any harm in using this material as anodes for our copper plating (cyanide) bath? If this amount of cadmium interferes, can you tell us how it might be removed?

H. J. C.

Answer: Except for a slight brassy color, there should be no problem in using this material for copper plating. The cadmium will co-deposit with the copper, but we doubt if this small percentage would cause any harm. One way the cadmium could be removed would involve re-melting the alloy under oxidizing conditions, when the cadmium would be oxidized and pass off as a vapor. Such a method would be wasteful of the copper, however, as some of it would also be oxidized at the same time.

Silver Alloy Plating

Question: We are interested in the deposition of alloys of silver, either with one or several other metals. Can you tell us where we might obtain some information on this subject?

F. E. E.

Answer: The most extensive discussion of silver alloy plating was contained in the *Transactions of the Electrochemical Society*, Volume 74, by *Mathers*. This covers deposits of silver with copper, nickel, iron, cadmium, cobalt, and lead.

Several recent patents were also granted for alloy silver deposition. These are patent 2555375, for silver-antimony alloys, and patent 2551413 for diffused deposits of silver-indium-thallium.

White Brass vs. Zinc Plating

Question: We have heard a lot about white brass plating, and are wondering what advantages it might have, if any, over bright zinc plating? We use a final 5 minute chrome plate over our present zinc, followed by coloring and lacquering. Our products are made of steel.

W. A. D.

Answer: When used under chrome plating, about the only advantage of the white brass plate is that you could probably eliminate the coloring operation, as it is usually possible to de-

posit the chrome in a very bright condition directly over the white brass. This is not possible with chrome over zinc. The white brass is not recommended in thicknesses over .0003" because of its tendency toward brittleness and cracking. According to some users, the white brass bath seems to have a levelling effect which is not possessed by the zinc plating baths.

A thin copper plating is also recommended as an undercoat for the white brass.

Blistered Silver Plating

Question: We are having trouble with our silver plating on steel parts after annealing. The parts are fired in hydrogen at 1,000°C. for 2 hours, after which they are pickled, nickel plated for 1 hour, silver strike plated, then regular silver plated to a thickness of .001". After this the parts are again hydrogen fired at 875°C. for 2 hours. We are sending some samples for your examination, and would appreciate any help you can give us on how to overcome this problem.

K. H. G.

Answer: By lifting some of the blisters with a sharp knife point it was noticed that dark, blackish spots were underneath each blister. As the thickness of the deposit which lifted was not sufficient to account for both a 1 hour nickel plate and a .001" silver deposit, it is logical to conclude that the dark spots are on the surface of the nickel deposit, and that the basic problem is the lifting of the silver from the nickel plating.

The cleaning or treatments between the nickel and silver plating steps should be checked to determine what could be causing this trouble. Perhaps a short reverse-current activation and cleaning step could be used here to eliminate this trouble, but without knowing the exact procedure you follow it is difficult to point out the exact cause.

Lacquering Over Chrome Plate

Question: We have heard of a chromic acid dip that can be used to promote adhesion of clear lacquers over chromium plating. Can you give us any information on such a dip?

B. J.

Answer: Immersion of the freshly chromium plated parts in a 2% solution of chromic acid, used at about 150-160°F., will help materially. There seems to be some difference of opinion as to whether rinsing after this treatment is beneficial or detrimental, but practice seems to favor no rinsing. The retained heat of the parts should be sufficient to dry the water off. A higher temperature in the chromic acid dip will help in this respect if it is necessary on some small parts which do not retain enough heat to be self-drying.

Erratic Colors with Anodizing

Question: We have difficulty in maintaining uniform colors in our dyed anodizing department. At present we run two shifts, and one shift seems to get good results on the same parts, using the same solutions and dye baths that are used by the day shift. This eliminates the solutions as a factor, and we would like to know what other points may be varying enough to cause this kind of trouble.

N. S. S.

Answer: The principle factors effecting the color are the thickness and absorbency of the anodic coating, the rinsing before dyeing, and the pH of the dye solutions. You did not mention what kind of power and controls you were using, but if the voltages during the initial stages of the anodizing are adjusted manually you can get very different results depending on how rapidly the voltage is increased. The important thing is to maintain a current density of about 15 a.s.f. at all times during the preliminary part of the cycle. An automatic program control on your power source would be very helpful on this. You should also watch out that the rinsing after anodizing is properly controlled. Water which is too hot will tend to seal the coating and prevent dye absorption, whereas insufficient rinsing will carry acid over into the dye baths and cause a change in their pH, which will cause the color to vary. Time and temperature in the dye bath are also very important. All these things must be very carefully standardized for good color control, which is still one of the trickiest operations in the whole metal finishing field.

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Patents

Recently Granted Patents in the Metal Finishing Field

Descaling Stainless Steel

U. S. Patent 2,569,158. *C. B. Francis, assignor to U. S. Steel Co.*

In a method of descaling articles of stainless steel, the steps including immersing the articles in a bath of fused sodium hydroxide, pickling the articles in a dilute aqueous solution of sulphuric acid, and then dipping them in a dilute aqueous solution of nitric acid.

Machine for Continuous Plating of Strip

U. S. Patent 2,569,578. *E. W. Rieger, assignor to National Steel Corp.*

In apparatus for progressively electroplating strip, the combination comprising, a tank for holding a bath of electroplating solution, means for moving the strip along a horizontal path across the tank from the entry end to the exit end whereby the moving strip drags electroplating solution in the direction of strip travel, means for supplying electroplating solution to the tank, an electroplating anode disposed in said tank below the path of the strip, said tank having a bottom wall, side walls extending upwardly from the bottom wall above the path of the strip across the tank for preventing spillage of electroplating solution across the side walls, an entry end wall extending upwardly from the bottom wall toward the path of the strip and terminating below the path of the strip and below the side walls, said tank being free of means preventing the spillage of solution across the top of the entry end wall and said entry end wall forming a discharge weir for the solution at the entrance end of the tank, and an exit end wall at the exit end of the tank extending upwardly from the bottom wall toward the path of the strip, said strip moving means comprising a pair of strip engaging rolls including an upper roll and a lower roll adjacent the discharge end of and positioned outside of the tank, one of said rolls being a contact roll for making electrical contact with the strip, means for connecting the contact roll and the anode to a source of electric current, sealing means extending between reach of the side walls of the tank and the rolls and sealing means extending between at least one of the rolls and the exit end wall of the tank, the sealing means with the rolls preventing the spillage of electroplating solution from the exit end of the tank so that substantially all of the spillage of electroplating solution from the tank is across the entry end wall in a direction countercurrent to the direction of strip movement across the tank, and means extending beneath the entry end of the tank for collecting the electroplating solution spilling over the entry end wall of the tank.

Activating Nickel After Stripping Chrome

U. S. Patent 2,570,174. *C. F. Weber, assignor to Geenral Electric Co.*

The method of replating a nickel plated article from which a chromium plate has been stripped by anodic treatment in a caustic alkali solution for replating, which method comprises immersing the nickel plated article in a strong hydrochloric acid solution and passing a current through said article as the cathode for about one minute at a current density of from 75 to 100 amperes per square foot, applying a flash coating of copper onto said article and nickel plating the copper flashed article.

Buffing Compound

U. S. Patent 2,570,904. *C. B. F. Young, assignor to National Southern Products Corp.*

In a buffing compound, an abrasive, a vehicle consisting essentially of a mixture of a higher saturated fatty acid and tall oil, the tall oil varying from one-third by weight the amount of the saturated fatty acid to an amount equal thereto, and said vehicle having a titer of from 40° to 45°C.

Buff Design

U. S. Patent 2,571,147. *G. A. Lyon.*

A buff assembly comprising an elongated arbor having a central axis of rotation and on irregular outer peripheral surface, said arbor having an axially extending recess in the surface thereof, a plurality of concentric grooves in said arbor surface extending from one lip of said recess to the other, a block insertable in said recess and having grooves in its outer surface extending across the periphery thereof and arranged to align with the ends of adjacent pairs of concentric grooves at one side thereof with the next adjacent grooves at the opposite side thereof, and a continuous buffing element in flat strip form wound in the grooves of said arbor and said block and secured at its ends to said arbor.

Making Buffing Wheels

U. S. Patent 2,571,148. *G. A. Lyon.*

In a method of making a buffing wheel out of a strip of buffing material folded about a cable for securing the strip in a peripheral spiral groove of a wheel, the steps of stitching layers of buffing material along two substantially parallel lines at a general medial area in a continuous strip of the material, applying a winding cable to the strip between said lines of stitching, winding said strip and cable into the spiral wheel groove and contemporaneously folding the sides of the strip about the cable in the groove while crowding and bulging the excess material, due to the folding of the strip, over the cable so that the cable is substantially enveloped by the folded material in the groove.

Removing Rubber from Metals

U. S. Patent 2,571,328. *J. C. Baker, assignor to The Ohio Rubber Co.*

The method of cleaning metal articles of adherent rubber and related carbonaceous deposits which comprises rendering such adherent rub-

ber and deposits crumbly by subjecting the same to the action of a fluorinating agent, and thereafter mechanically abrading such deteriorated rubber and deposits to remove them from the metal surface.

Degreasing Machine

U. S. Patent 2,571,581. *T. J. Kearney, assignor to Detrex Corp.*

In a metal degreasing machine, a vapor solvent well and rinsing solvent well, a plurality of sprockets, a pair of conveyor chains in engagement with said sprockets, a plurality of cylindrical perforated work carriers rotatably mounted between the said conveyor chains, a pinion mounted integrally on one end of each said carrier, a rack for engaging said pinions, said rack being disposed over said vapor solvent well and extending into and out of said rinsing solvent well, a pair of guide rollers rotatably mounted on each said carrier at each end thereof, a top guide associated with and disposed over said rack for rolling contact with said guide rollers, an upper and lower guide mounted in paralleling relation on the side of the degreasing machine opposite from the side on which said rack is mounted, and disposed to receive said guide rollers, there between with rolling contact, both said top and upper guides being upwardly curved at the entrance ends thereof which receive said guide rollers in operative rolling contact.

Machine for Copper Plating Wire

U. S. Patent 2,571,709. *A. N. Gray, assignor to Western Electric Co.*

An apparatus for copper plating steel wires, which comprises a container, a copper pipe extending along the container, a drain fitting composed of electrical insulating material secured to one end of the pipe and having an opening in alignment with the pipe through which a steel wire to be plated may extend in close-fitting relationship, said fitting having a channel for directing liquid from the pipe, a supply fitting composed of electrical insulating material secured to the other end of the pipe and having an opening in alignment with the pipe through which the steel wire may extend, said supply fitting also having a channel for directing liquid to the pipe, a supply pipe connected to the supply fitting and supporting the supply fitting, the copper pipe and the drain fitting in positions out of contact with the container for supplying electrolyte to the copper pipe, electroconductive wire-streaching elements connected to and electrically insulated from the walls of the container for supporting the steel wire in a position centered for creating a difference of potential between the copper pipe and the wire-stretching elements.

Hot-Dip Coatings of Aluminum, Zinc, Lead, Cadmium, and Tin

U. S. Patent 2,570,906. *M. Alferieff.*

A process of coating metallic bodies with a metal selected from the group consisting of aluminum, zinc, lead, cadmium and tin which comprises heating the said bodies to a temperature within the range 1,470°-1,670°F. in the presence of a reducing atmosphere consisting predominantly of hydrogen and containing from 2 to 30% water vapor, then expelling occluded gases from said bodies by heating them to at least the temperature attained in said first heating step while in direct contact with an inert atmosphere consisting predominantly of nitrogen, and while maintaining said bodies wholly protected by an inert atmosphere consisting predominantly of nitrogen and substantially free from water vapor, cooling them to a temperature not exceeding the temperature of the molten bath of the coating metal, and then passing them into said coating metal bath.

Soft Grit Wet Blasting

U. S. Patent 23,422. *F. R. Perry, assignor to Turco Products, Inc.*

The method of cleaning metal articles which consists of projecting thereagainst a stream of fluid under pressure carrying, in suspension therein, pelletized nut shells having the hardness of black walnut shells.

Buff Design

U. S. Patent 2,572,092. *H. H. Bahr, assignor to Guaranteed Buff Co., Inc.*

A buffing wheel comprising a hub having a circular periphery, a plurality of rim sections secured to said hub and extending beyond said periphery, the plane of said sections being at an angle to the plane of said hub, a plurality of pieces of fabric in the spaces between adjacent sections, each piece of fabric being substantially in a plane passing through the center of said hub, said fabric constituting a buffing surface, and means for securing said pieces to said sections including tongues in said sections, said pieces being stacked from the face of each section into contact with the face of the adjacent section, extending peripherally of said hub, said pieces having openings complementary to said tongues, the letter passing through said openings.

Buff Design

U. S. Patent 2,572,093. *H. H. Bahr, and G. Becker, assignors to Guaranteed Buff Co., Inc.*

A buffing wheel comprising an annular body of a fabric folded at its central periphery to form a doubled-up cylinder, said cylinder being flattened forming substantially radial pleats, a ring within said fold at said inner periphery, a central disk having means for mounting on a shaft, the outer periphery of said disk being spaced from the inner edge of said folded fabric, a series of radially alined independent connector members having the inner end anchored within the body of said disk and extending substantially radially therefrom, the outer end of said connectors piercing said fabric adjacent to said fold and embracing said ring.

Plating and Heat Treating Tempered Spring Steel

U. S. Patent 2,572,219. *K. B. Valentine, assignor to General Motors Corp.*

The method of processing parts formed of hardened and tempered steel having a Rockwell C hardness of at least 50 which comprises heating the steel at a temperature within the range of 1,000°F. to a temperature just below the lower critical range of the steel (Ac_1) for a time within the range of about one to two hours, thereafter heating the spring steel to a temperature within the range of about 1,500° F. to 1,650°F. to austenize the same, quenching said heated spring steel to harden the same, tempering said hardened spring steel by heating the same to a temperature within the range of 400°F. to 750°F., electrodepositing onto said hardened and tempered spring steel a coating of the class consisting of zinc and cadmium, and then heating said spring steel and electrodeposited coating thereon at a temperature within the range of 200°F. to 400°F. for a time within the range of one to four hours.

Plating Zippers

U. S. Patent 2,572,838. *C. C. Cohn, assignor to Samuel L. Cohn and Charles C. Cohn.*

The method of electrolytically coating closed zippers formed of metal elements clamped on non-conducting carriers comprising winding a closed zipper about a metallic frame including a series of elongated members extending in substantial parallelism to provide a lattice, the zipper extending transversely across said elongated members, associating with said frame a second separate metallic frame including a series of elongated members extending in substantial parallelism to provide a lattice so that the members of the second frame project between the members of the first mentioned frame and impart to the closed zipper a sinuous configuration to produce a stressed engagement between the metal elements thereof, and subjecting the resulting assembly to an electrolytic action involving current conduction through the series of metal elements and thereby coating the metal elements of the zipper.

Buffing Wheel

U. S. Patent 2,573,874. *V. L. Richards, assignor to Canadian Hanson and Van Winkle Co., Ltd.*

A ventilated buffing wheel assembly comprising a plurality of annular buffing sections of flexible material arranged side by side; a spacing and supporting hub for each of said sections comprising a disc having a central aperture to receive a spindle and a plurality of perforations radially disposed with respect to said aperture to form axially extending air passages and a plurality of radial flutes stamped at intervals in the outer periphery of said disc and extending inwardly from the peripheral edge of the disc and a ring attached between the spaced radial flutes to one side of said disc adjacent the outer periphery and overlaying said flutes, said ring having an axially extending flange centering and supporting said annular buffing section, the depth of said ring from the outer edge to the inner edge thereof extending inwardly a smaller distance radially of said disc than the inward extent of said spaced radial flutes and thus defining with said flutes radial air passages; and means clamping said sections and hubs for rotation with a spindle as a unit, said means having perforations therethrough to permit ingress of air.

Buff Design

U. S. Patent 2,574,037. *F. E. Hendrickson, assignor to Murray Ireland.*

In a folded buffing section for a composite buffing wheel having a rotatable central hub with a plurality of holding means at the periphery thereof for supporting folded buffing sections thereon, in combination, a plurality of separate flexible oval plies having substantially the same size, a plurality of smaller oval plies, graduated in size and interspaced with the larger plies, the major axes of the larger plies lying substantially parallel to each other, the major axes of the smaller plies lying substantially paralel to each other but lying across the major axes of the larger plies, all said plies lying together and having a fold that embraces all said plies, said plies including means near the folded edge for engaging the hub and fastening said section thereto, and a binder near said hub-engaging means for holding said plies together.

Inhibited Acid Pickling Bath

U. S. Patent 2,574,049. *J. T. Mayhew, assignor to National Steel Corp.*

A sulphuric acid pickling bath containing an added compound selected from the group consisting of titanium tetrachloride, titanium trichloride and mixtures thereof, said compound being present in an amount not greater than 1% by weight of the bath.

Plating over Chrome Plate

U. S. Patent 2,574,305. *R. M. Wagner, assignor to General Motors Corp.*

A process of activating a metallic part having a plating of chromium thereon so that an adherent, metallic coating may be electrodeposited thereover which consists essentially in making the chromium plated part the cathode in a solution consisting essentially of 6 to 32 ounces of nickel sulfate and 6 to 32 fluid ounces of commercial concentrated hydrochloric acid per gallon of water, and passing direct current from a nickel anode through said solution to the chromium plated part at a cathodic current density within the range of 15 to 150 amperes per square foot for a time within the range of approximately 10 to 30 seconds, said solution having a temperature within the range of approximately 70°F. to 125°F.

Immersion Nickel Coating of Pistons

U. S. Patent 2,575,214. *D. L. Garland and R. D. Gray, Jr., assignors to Wright Aeronautical Corp.*

A piston having an annular groove for the reception of a piston ring, at least one side wall of said groove having an alloy surface layer with a composition comprising principally nickel and phosphorus.

Strip Plating Machine

U. S. Patent 2,575,409. *W. B. Cooper and P. A. Burgemeister, assignors to Crown Cork & Seal Co., Inc.*

A collector device for electrodeposition apparatus, comprising a housing, a collector roll shaft extending into said housing and mounted for rotation, a conductor member having a ring contact carried by said shaft within the housing, a ring member fixed against rotation and carrying radial contacts adapted to be engaged by said conductor member in its rotation on said shaft, a conductor block supported in said housing and carrying said fixed member, means constantly urging said radial contacts toward said conductor member to thereby assure continuous engagement between the fixed contacts and the rotating conductor member, said means being carried by said block and including spring-pressed pins having heads which are normally urged into engagement with said radial contacts, said block having a conductor projection extending through a wall of said housing, and an electrical connection to said projection, whereby current is passed through said shaft to its roll for imparting a charge to a strip passing over the roll during electroplating.

Addition Agent for Acid Zinc Plating

U. S. Patent 2,576,997. *A. E. Chester, assignor to Poor & Co.*

An acid zinc plating bath comprising zinc sulfate dissolved in an acidic aqueous liquid containing a member from the group consisting of aldonic acids and aldonates in a quantity at least effective to produce antiburn effects in said bath.

Measuring Average Thickness of Plated Coatings

The average thickness of electroplated coatings may be measured by determining the total weight of coating on a given area, either by selectively dissolving the coating or the base metal. The average thickness is then calculated from the weight of metal, its density, and the area. The following formulae may be used for calculating thickness. The appropriate values of "K" are obtained from Table I below.

$$(1).\quad \frac{\text{Weight of coating (oz.)} \times K_1}{\text{Area (sq. in.)}} = \text{Thickness (inch)}$$

$$(2).\quad \frac{\text{Weight of coating (grams)} \times K_2}{\text{Area (sq. cm.)}} = \text{Thickness (cm.)}$$

$$(3).\quad \frac{\text{Weight of coating (grams)} \times K_3}{\text{Area (sq. cm.)}} = \text{Thickness (inch)}$$

$$(4).\quad \text{Milligrams per sq. inch} \times K_4 = \text{Thickness (inch)}$$

Mixed units are used in formula (3) because the chemist uses the metric system, whereas the plater desires the thickness to be expressed in inches.

Some specifications require a certain number of milligrams of metal per square inch as per Formula 4. These hybrid units are not to be recommended. The constant K_4 in the Table is the thickness of coating in inches corresponding to a weight of coating of 1 mg. per sq. inch.

TABLE I

	K_1	K_2	K_3	K_4
Cadmium	0.201	0.116	0.0458	0.0000071
Chromium	0.243	0.141	0.0554	0.0000086
Copper	0.195	0.112	0.0443	0.0000069
Gold	0.0896*	0.052	0.0204	0.0000032
Indium	0.237*	0.137	0.0539	0.0000084
Lead	0.153	0.088	0.0348	0.0000054
Nickel	0.195	0.112	0.0443	0.0000069
Palladium	0.152*	0.088	0.0346	0.0000054
Platinum	0.0810*	0.047	0.0184	0.0000029
Rhodium	0.139*	0.080	0.0316 *	0.0000049
Silver	0.165*	0.095	0.0375	0.0000058
Tin	0.237	0.137	0.0539	0.0000084
Zinc	0.243	0.141	0.0554	0.0000086

**Calculated on basis of avoirdupois ounce.*

(From the Manual of The NAMF)

Electronic Plating Thickness Tester

Kocour Co., Dept. MF, 4800 S. St. Louis Ave., Chicago 32, Ill.

The Kocour Electronic Thickness Tester operates by anodically deplating a small area of the specimen. The cell which holds the test solutions also serves as a cathode, and the article to be tested is made the anode.

At the start of the test and until the base metal is exposed, a voltage characteristic of the plating exists across the cell; when all of the plating has been removed from the test spot, this voltage changes sharply and assumes a new value which is now characteristic of the base metal. This rapid voltage change is the "endpoint" of the test, and is amplified and caused to operate a relay which turns off the instrument. About 1 minute is required per test.

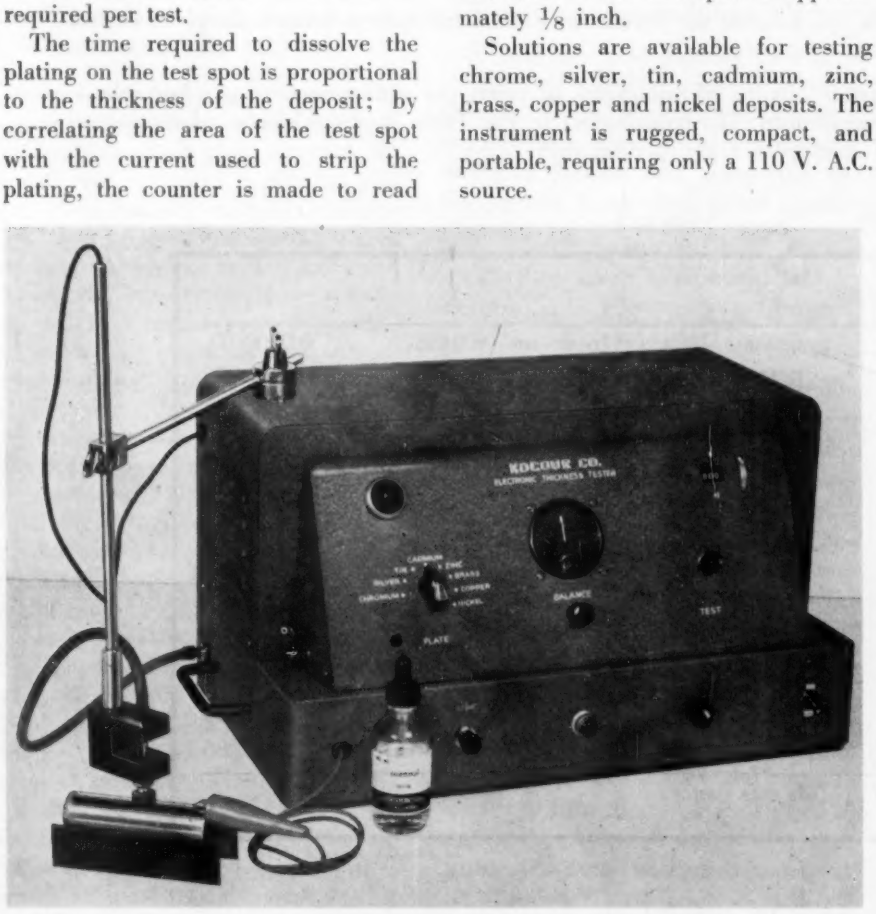
The time required to dissolve the plating on the test spot is proportional to the thickness of the deposit; by correlating the area of the test spot with the current used to strip the plating, the counter is made to read directly in units of thickness. Thus, no calculations or references to graphs or charts are necessary to obtain the thickness. The minimum thickness which can be checked is .00005" (.000005" for chrome).

Essentially the instrument embodies a miniature reverse-current plating cell in which the article to be tested is the anode and the cell itself is the cathode.

The test solutions used are specifically designed to give 100% anodic current efficiency. They do not attack the plating unless current is flowing through the test cell. The anode efficiency is further maintained by providing agitation of the solution in the test cell.

The test spot is defined by means of a small rubber gasket having an accurate dimensioned perforation. The diameter of the test spot is approximately ⅛ inch.

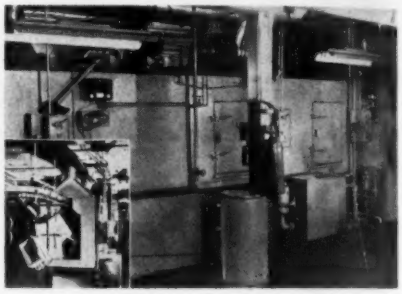
Solutions are available for testing chrome, silver, tin, cadmium, zinc, brass, copper and nickel deposits. The instrument is rugged, compact, and portable, requiring only a 110 V. A.C. source.



New Washing, Metal Treating Machine

Industrial Washing Machine Corp., Dept. MF, New Brunswick, N. J.

Currently processing carbon steel wire frames and metal stampings for *The Andrew B. Hendryx Co.*, of New Haven, Conn., the overhead monorail washer below features a high capacity of 36 square feet of work per minute.



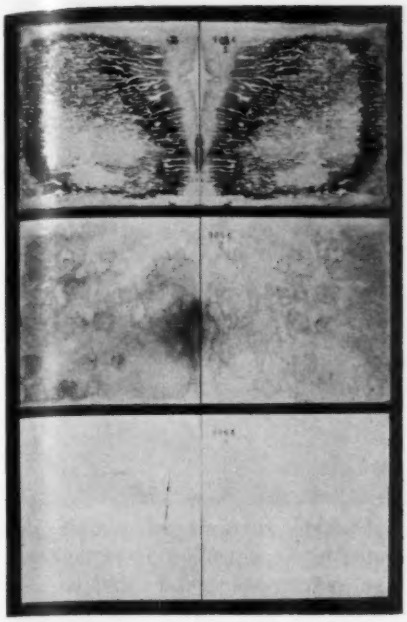
The four operations performed automatically by the machine are in order: Phosphatize . . . clear water rinse . . . chromic acid bath . . . and drying. These are said to impart to the work an excellent surface for spray painting, resulting in a much longer painted life. Other benefits are elimination of paint peeling and reduction of paint-fault rejects, according to the manufacturer. Designated as Model OM 20 X 34-W-CWR-CAR-D, the machine measures 30′ x 6′ x 7′ high and utilizes existing steam line for heating solutions. Further facts and detailed information will be promptly supplied upon application to the manufacturer.

New Treated Paper Solves Aluminum Water Stain Problem

Kaiser Aluminum & Chemical Sales, Inc., Dept. MF, Oakland 12, Cal.

A chemically treated interleaving tissue paper to prevent water staining during storage of aircraft quality aluminum flat sheet products was recently announced by the Division of Metallurgical Research of *Kaiser Aluminum & Chemical Corp.*

Available for use by the entire metal industry, the newly developed tissue



Panels from different test packs which had been exposed to the 30-day "High Humidity" test. Top, no interleaving tissue; center, interleaved with untreated tissue; bottom, interleaved with inhibitor impregnated tissue.

already is being produced by several leading paper manufacturers.

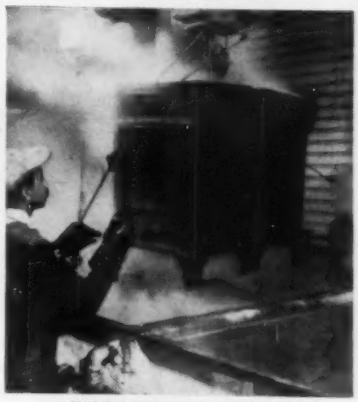
For many years, metal producers have used interleaving tissues to protect finished surfaces from abrasion marks. However, the new Kaiser paper not only serves as a cushion against abrasion, but it is also treated with a chemical inhibitor compound that eliminates the water staining which takes place between the stacked sheets of most metals and many non-metals.

Water staining, a problem that has plagued nearly all metal manufacturers as well as the makers of common window glass, is initiated by sharp and sudden changes in temperature which cause the formation of a water condensate similar to dew. This moisture is drawn into the minute crevices between the sheets of stacked metal where a combination of moisture, weight pressure, and lack of air provides the necessary conditions for this particular type of corrosive attack.

Scientific investigations have shown that water stains do not alter the physical properties of aluminum and that the stains will not appear on moistened aluminum under ordinary service conditions. However, the same aluminum sheet products that give good weathering performance, will occasionally show water stain in warehouse stacks that have not been interleaved with the inhibited tissue. The entire development of these tissues is under the patent rights of the above firm.

OCTAGON Phosphate Coatings . . .
. . . solve Metal Finishing Problems

PAINT ANCHORING



ANCHORITE 100

ANCHORITE 100's phosphatizing action changes the surface of steel, iron, zinc and cadmium parts into a paint-anchoring corrosion-resistant phosphate. This fine, uniform crystalline coating meets U.S. Army Ordnance Specification 57-0-2C, Type II, Class C, and JAN-C-490, Grade 1.

The ANCHORITE 100 treatment is applied by either immersion or spray. Any formed metal product, from a diaper can to an automobile body, can be improved with an ANCHORITE 100 prepainting treatment.

OIL RETAINING • RUST PROOFING

RUSTSHIELD 2

RUSTSHIELD 2 phosphatizing compound produces oil-retaining, wear-resisting, rustproof surfaces on ferrous metals. Properly lubricated RUSTSHIELDED surfaces prevent scuffing and galling, and reduce break-in time. RUSTSHIELD 2 is applied to such rubbing and sliding parts as thrust washers, pistons, gears, and valve components. Corrosion resistance is multiplied by an oil or wax finish.

RUSTSHIELD 2 meets U.S. Army Ordnance Spec. 57-0-2C, Type II, Class A and MIL-C-16232 (Ships) Type I.

What's Your Metal Finishing Problem?

A CORROSION-RESISTANT PAINT BASE?

AN OIL-RETENTIVE RUSTPROOF SURFACE?

OCTAGON PROCESS INC., 15 BANK STREET, STATEN ISLAND 1, N. Y.

Please send detailed information on the following OCTAGON phosphate treatments:

☐ Anchorite 100 ☐ Rustshield 2

NAME_____ TITLE_____

ADDRESS_____

CITY_____ STATE_____ MF

OCTAGON PROCESS INC.

15 BANK STREET, STATEN ISLAND 1, N. Y.

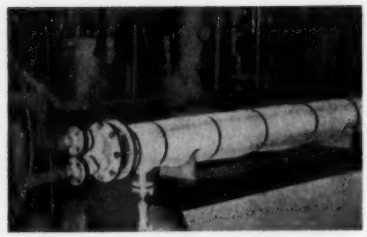
MANUFACTURERS OF: RUSTCLEAN • PROTECTORITE (RUSTPROOFING COMPOUND) • ACID PHOSPHORIC CONDITIONERS • METAL CLEANERS • PHOSPHATIZING COMPOUNDS • PICKLING INHIBITORS • PAINT STRIPPERS • BRIGHT DIPS

Here's How You Can Solve Your Acid Heating Problem *in a hurry!*

Investigate the many outstanding performance features of *HEIL* Impervious Graphite *"NOCORDAL" Units.**

1. LONGER SERVICE LIFE

"NOCORDAL" is inert to most strong acid solutions. Ideal for iron plating as well as Bright Nickel Baths, Hydrochloric and other strong acids.

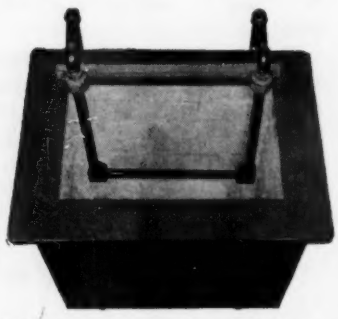


Shell and Tube Exchangers with "NOCORDAL" Tubes. Standard sizes for ready selection. Also available with nickel, steel and other alloy tubes.

"NOCORDAL" Grid Heater provides excellent circulation of solution around heating surface. Rugged construction gives longer service life.

2. MORE EFFICIENT OPERATION

"NOCORDAL" possesses the highest heat transfer rate of all non-metals and higher than most metals. This means real savings to you because of more efficient operation.



"NOCORDAL" "U" Coils. These immersion units also available in "L" shape and Bayonet style.

3. LOWER INITIAL COST

This wide selection of standard designs will fit practically all applications with efficient pre-engineered units.

Products of HEIL PROCESS EQUIPMENT CORP. are sold by all leading Electroplating Jobbers.

Specify
HEIL "NOCORDAL"
units to solve your heating problem.
**Trade Name*

Other HEIL Products Include

LEAD ANODES • TANKS LINED WITH RUBBER, KOROSEAL, LEAD • LINED FUME DUCTS • PLASTIC CONSTRUCTION • LINED DRUMS • ACID PROOF MAINTENANCE MATERIALS • LEAD FABRICATION

SPECIALISTS IN CHEMICAL-PROOF EQUIPMENT

HEIL PROCESS EQUIPMENT CORP.

12901 Elmwood Ave. **Cleveland 11, Ohio**

Protective Coating for Plating Tanks

Munray Products, Inc., Dept. MF, 12400 Crossburn Ave., Cleveland 11, O.

Outside surfaces of plating rinse tanks need protection from acid spillage, plating salts, and other corrosive chemicals. The above firm has developed a "putty-like" plastic paste easily applied with a hand trowel which provides an excellent protective coating.

Because it is applied by hand, this plastic putty can be spread on any desired surface and to any thickness. In the case of the plating tanks, the coating is usually 1/16"-1/8". These coatings formerly were difficult to apply without using costly special dipping equipment. A wide variety of other uses for this plastic putty are under development.

This coating compound is made by adding a gelling agent to a paste based on Geon 121 vinyl resin, a product of *B. F. Goodrich Chemical Co.* Besides resisting most acids and chemicals, Geon has good resistance to oils, greases, abrasion and aging, it is claimed.

Fusing the plastic putty coating is done either by oven baking or infrared lamps. It will reach a Durometer A hardness of 90-95. Because it contains no volatile materials, it can be applied safely, and there is no change in viscosity during storage.

Geon polyvinyl chloride plastic is used in a wide variety of other products for both home and industry, such as household and automotive upholstery, self-adhering film, and fire resistant safety clothing.

Zinc Plating on Magnesium

Wire Coating & Mfg. Co., Dept. MF, 395 East 131 St., Cleveland 8, O.

By using a new coating process developed by the above firm it is now possible to produce zinc plated magnesium sheets that are finding wide

acceptance in the photoengraving and printing industries. For many years copper and zinc sheets have dominated this field, but the newer magnesium sheets have a number of advantages in addition to a weight advantage. These are fast etching, fine grain, accurate dot formation. durable, not easily distorted under cold and heat cycles, and easily machined. The new zinc plated magnesium sheet enables all these advantages to be realized, as well as saving critically short copper metal, and permitting conventional etching and rinsing procedures. The Nuloy plate combines the accurate reproduction qualities of zinc with the rapid etching of the magnesium base metal to give a more economical, truer reproduction of halftones and line cuts.

The process for depositing zinc directly on the magnesium sheet is a development of the above firm, specialists in the field of chemicals and addition agents for electroplating.

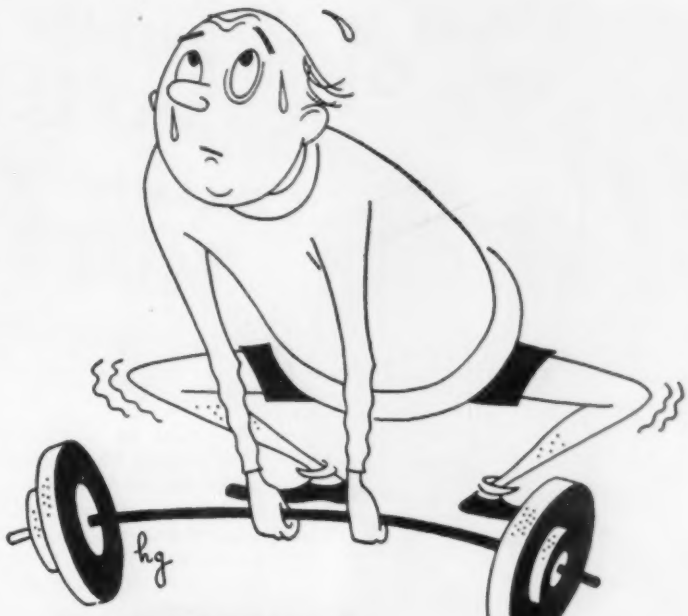
New Bright Silver Plating Process

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

This firm announces a new commercial silver plating process which makes it possible to obtain bright silver plate without buffing or scratch

Spoon on right was plated by new Silver-Lume bright silver plating process. Other spoon was plated by conventional silver plating method. Evenness of reflected pattern on Silver-Lume plated spoon illustrates the perfection of the process. Both spoons appear as taken from plating tanks.

a cost reducing exercise



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Abrasive Grain

Trim your polishing costs! Get your department in shape for maximum output. Set-up with Simonds Borolon grain . . . tough, sharp, free-cutting . . . coarse, medium and fine . . fit for every polishing job . . . part of a complete line including grinding wheels, mounted wheels and points, segments . . . top quality products backed by Simonds' 60 year reputation as a major producer. Write for Bulletin ESA 198, which describes various grain types. Also request name of your distributor.

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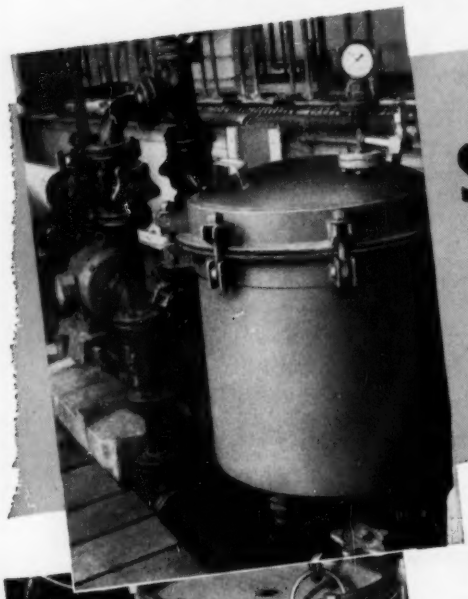
Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co. Ltd., Arvida, Que.

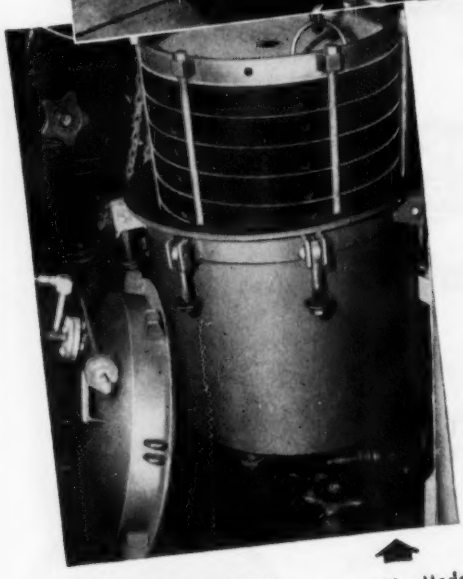
No repairs or maintenance in over 17,000 hours of 'round-the-clock operation



. . . yet this SPARKLER Horizontal Plate FILTER is still going strong

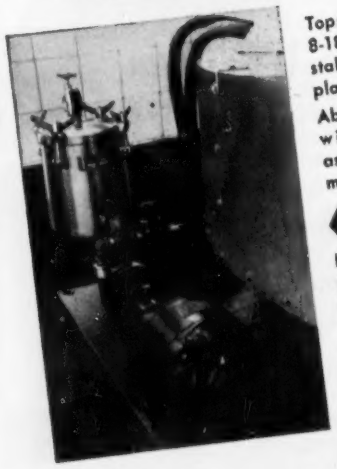
The kind of service Sparkler Horizontal Plate Filters have given the Gillette Safety Razor Company—efficient and trouble-free, even under most extreme conditions—is the kind of service that is vital to *every* filtering operation.

For example: A rubber-lined Sparkler Model 8-18 filter is used by Gillette in the continuous filtration of a 1000-gallon bright nickel plating solution. Now operating for approximately two years, this filter has been on a 24 hours a day, 7 days a week schedule — without any loss of operating time for repairs or maintenance. Also used in periodic batch carbon treatments of nickel solutions this unit, according to Gillette technicians, consistently delivers a brilliantly clear effluent, even though the plates may be packed solid.



Another Sparkler Filter employed by Gillette is a Model 8-6, stainless steel, portable unit. Used exclusively for cyanide type plating solutions, this Model 8-6 has proved particularly valuable for Gillette's gold plating operations since the patented Sparkler Scavenger Plate assures minimum loss of precious gold solution. Now operating almost six months for at least 2 hours daily, its performance has been satisfactory in every respect.

Top: Sparkler Model 8-18 filter shown installed in Gillette's plating department. Above: Same filter, with filter plate assembly being removed for cleaning



Left: Sparkler Model 8-6 stainless steel filter. This portable unit is used by Gillette to filter gold plating solutions.

Our Engineering Department (with more than 25 years' experience in every phase of filtration) is available for consultation without charge.

SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS

brushing. Until now, buffing, brushing or electropolishing has been a necessary step in brightening silverplated surfaces. Called Silver-Lume, the new process is said to eliminate the usual buffing and brushing costs; produce a noticeably more tarnish-resistant surface; have a wide bright range; require no special equipment; produce an excellent deposit-distribution and uniform color; be easily controlled; be low in cost.

Conventional plating equipment as used for ordinary cyanide silver baths is satisfactory. A new bath is prepared from silver cyanide, potassium cyanide and potassium carbonate with small amounts of Silver-Lume Brighteners A and B. The potassium salt solution is preferred over one prepared from sodium salts, as the latter has a much narrower bright range. Existing solutions can, in most cases, be converted to the Silver-Lume Process. Sometimes, however, such baths require special treatment with activated carbon to remove undesirable impurities. Old baths high in sodium salts, especially sodium carbonate, may require increased concentrations of both A and B Silver-Lume brighteners with subsequent electrolysis for several days in order to obtain a wide uniform brightness range.

The Silver-Lume Process may be operated over a wide range of current densities and is claimed to give fully bright deposits at current densities higher than those used in most silver plating operations. The permissible current density depends principally on the metal content, the temperature and degree of agitation. High metal content, high temperature and vigorous agitation permit the maximum current to be used. The temperature may vary in the bath from 70-120°F. Under favorable conditions current densities of up to 55 a.s.f. can be employed. Plating is therefore much faster than in conventional solutions operating at current densities from 5-10 a.s.f.

Before announcing the process for general sale, many test installations were operated on a commercial basis. Users are said not only to have reported full-bright deposits, but also commented favorably on deposit distribution, savings in buffing or scratch brushing, and freedom from operating difficulties that are often inherent in a new process.

The laboratory of Hanson-Van Winkle-Munning is fully equipped to

process sample articles and will be pleased to demonstrate the effectiveness of the Silver-Lume Process on samples submitted. When sending samples, prepare the base metal exactly as it normally would be prepared for regular silver plating.

Neoprene Maintenance Coatings

E. I. Du Pont de Nemours & Co., Dept. MF, Wilmington, Del.

The synthetic rubber, neoprene, is familiar enough as an interior lining, either as sheet lining for chemical tanks or as heat-cured brushed coatings for complex shapes like pump and valve interiors. But most corrosion engineers are not yet aware that neoprene is now produced in a form which makes it eligible for maintenance work—for the exterior of tanks, process equipment, structural steel, pipelines and the like. The new material is not intended, like the older linings, for direct immersion in corrosive chemicals, but for protection against splash, spill and corrosive fumes and atmospheres.

Neoprene maintenance coatings are the result of two developments: first, a slightly modified neoprene polymer which, before vulcanization, produces solvent solutions of low viscosity per unit of solids content; second, accelerators which will cure this polymer at room temperature. Main ingredients of the coating are an aromatic solvent, carbon black, neoprene and a separately added accelerator. It dries by solvent evaporation and cures by polymerization of the neoprene.

The film itself has neoprene's excellent resistance to acids, alkalis, oils, most hydrocarbons, and highly important, to sunlight and weather. It is tough and rubbery, and its resilient qualities are inherent—not the product of plasticizers which may volatilize or leach out. Solids content is 60-70 per cent, giving a thick film per coat. Yet it brushes readily despite high solids content. The coating cures ready for service at room temperature in 24 to 48 hours by the addition of an accelerator at the time of use. A second coat may be applied two or three hours after the first coat without danger of brushing up the first. There is no rush, however; a fresh coat bonds well even to a fully cured prior coat, a fact which is also an advantage in patching or touching up an old coating.

It is a two-part system; the user

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FINISHES
for zinc, cadmium, aluminum and cuprous metals
provide corrosion resistance
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And they are easy to apply! Just a simple chemical dip for only a few seconds produces the coating.
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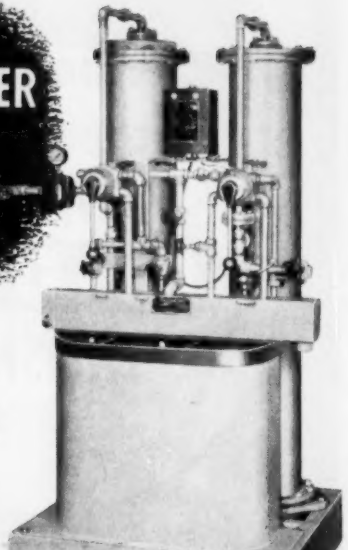

A two-bed INDUSTRIAL demineralizer unit. Standard units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Eliminate UNWANTED PRECIPITATES HOT WATER RINSE STAINS

These two difficulties in plating can be eliminated with one stroke—chemically pure water. Pure water in plating solutions improves the over-all quality of plated coatings. The use of pure water for hot rinses prevents stains and water marks after drying. With an INDUSTRIAL demineralizer chemically pure water costs so little that the unit pays for itself in a short time. It's easy to install and operate, and requires very little floor space.

Write for Bulletin 200

or send us a water analysis, letting us know the amount of treated water required in gallons per hour, and whether intermittent or continuous flow is needed. We will then give you the whole demineralizer story, including estimated cost, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

INDUSTRIAL Filters

A typical INDUSTRIAL stationary filter. Standard portable and stationary models are available with capacities 100 to 15,000 gph. Special filtering systems are engineered to meet unusual requirements.

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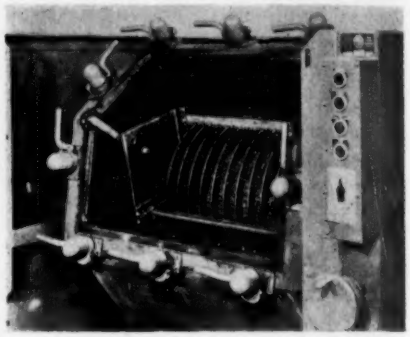
must stir a few ounces of accelerator into each gallon of material just before application. After acceleration, pot life is 12 to 36 hours, depending on amount of accelerator used. Before acceleration, shelf life is at least a year. To be sure of good adhesion, surface must be thoroughly wire-brushed or sandblasted and a coat of primer applied (chlorinated rubber is the recommended primer). Colors other than black can be had only at the expense of some chemical and abrasion resistance; light, pastel colors are not practical because neoprene darkens somewhat on aging.

Stationary Fixture Machine for Barrel Finishing

Roto-Finish Co., Dept. MF, 3600 Milham Rd., Kalamazoo, Mich.



A new addition to the line of mechanical finishing machines manufactured by the above firm is the DW 30-36-1SF, especially designed to affectively finish disc-type circular parts at a low cost. The machine, of the stationary fixture type, uses the directional flow of the finishing media to uniformly and efficiently produce desirable results.

Model DW 30-36-1SF has a single 30-1/8" x 35-1/4" I.D. rubber lined compartment with an 18 cubic foot capacity. Large door opening facilitates handling of the large parts for which the machine was designed. Patented quick action cam locks, used for closing the compartment door, have spring-loaded pressure releases, which prevent excessive pressure build up in the processing compartment.

The DW 30-36-1SF features push button operation, with all controls located on one compact panel. Once the machine is started, an automatic timer is available for controlling the operation from 0 to 20 hours without attention by an operator. A variable speed power unit with a conveniently located remote control handle enables

the operator to vary the speed of the cylinder from 10 to 30 revolutions per minute.

Side supports, motor mount and floor of the machine are all integral parts of the rigidly designed machine housing frame and eliminates the need of bolting it to the floor. The lower part of the housing is fully enclosed to prevent chips and water from lodging behind framework, a feature which makes the machine easier to clean and maintain.

Shafts of the rotating cylinder are mounted on 2-7/8" self-aligning ball bearing pillow blocks. To achieve accurate alignment all cylinders are built in alignment jigs and bearing shafts are double supported with welded gussets and bells. A special hoist pan is utilized for loading and unloading operation and is included as standard equipment. The DW 30-36-1SF like all the standard machines in the Roto-Finish line was designed to use the precision tumbling processes developed by the Roto-Finish Co. These processes use controlled rotary tumbling action and specially developed chips and compounds. They convert what were formerly expensive manual operations into low cost semi-automatic machine operations and product uniform results on each and every part.

All-Purpose Blackening Bath

Swift Industrial Chemical Co., Dept. MF, Canton, Conn.

A new, two-bath method for blackening all the ferrous alloys, malleable and cast irons and carbon steels has been perfected by the above company, according to recent announcement. Swift Nu-Black, as the method is called, is reported to be effective over a wide temperature range, creating a black surface of uniform density without bringing about any dimensional change in the piece so blackened. Company release states that Nu-Black's op-

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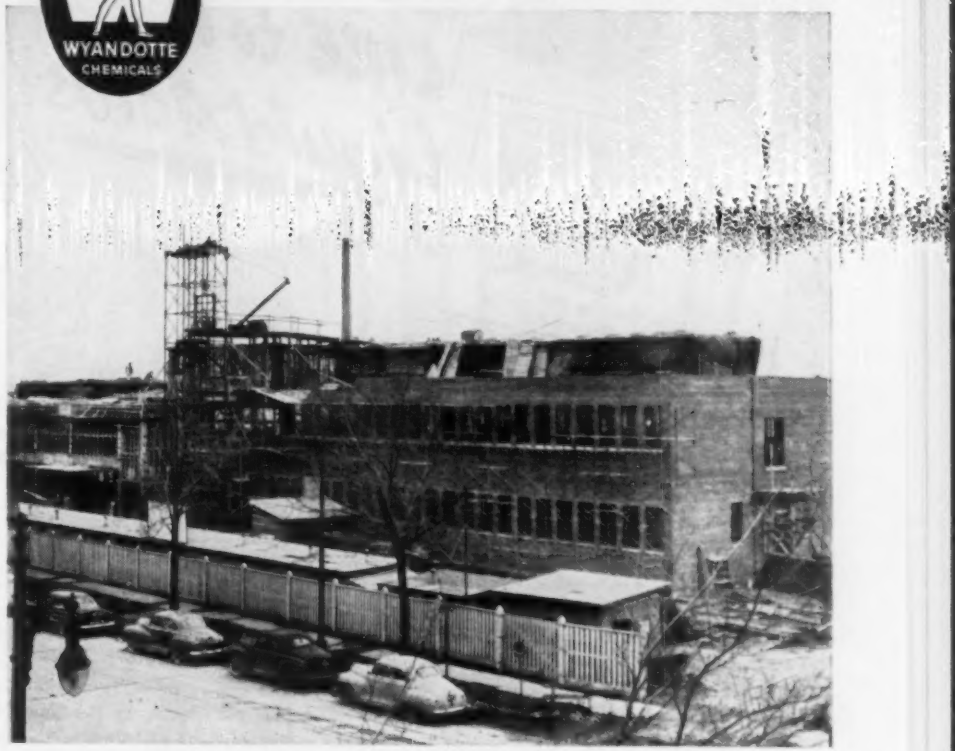

Wyandotte's new Research Building in progress

How Wyandotte's expansion program will help solve your cleaning problems

UP AND DOWN the line, we're doing everything we can to keep pace with the increasing needs and the new problems of industry.

New research facilities

Now under construction, for instance, is this new Wyandotte Research Building. When completed, it will contain the finest facilities for research into cleaning techniques and product application in the industry.

It will house complete metal-cleaning laboratories, a plant-size power washer, a complete set of plant cleaning and plating tanks, barrel-finishing equipment, corrosion-test facilities, a water-wash paint-spray booth . . . everything needed for developing, testing, and perfecting metal-cleaning and related products.

Production and service

Expanded production facilities, too, will help assure you of continuing dependable supply; and our newly augmented Technical Service Department will be able to give you, even more than before, the best technical help available.

All types of industrial cleaning, as well as barrel finishing, acid treatments, and paint stripping, are our specialties. Let our representative help you. *Wyandotte Chemicals Corporation, Wyandotte, Michigan; also Los Angeles, California.*

CLEANING THE WORLD

Largest manufacturers of specialized cleaning products for business and industry

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Helpful service representatives in 88 cities in the U.S. and Canada

The usual pickling acids are dangerous—both for those who handle them, and in storage. Their fumes can do real damage to nearby equipment. And they are strong in their action—with ever-present danger of excessive acid action on the parts being treated.

Use a Safe, Quickly Dissolved SOLID!

Magnus D-Scale-RS is a perfect substitute for liquid acids.

IT IS SAFE **. . . because it is shipped in chemically inert crystalline form. You dissolve it quickly and easily in water to make the working solution. Even then it does not give off corrosive fumes . . . and does not present a hazard to operators.**

IT IS EFFECTIVE **. . . because it removes the rust and scale you're after, in either hot or cold solution. At the same time it is inhibited to prevent attack on the metals being cleaned. And Magnus D-Scale-RS can be used in barrel work just as effectively as in tanks.**

If you're using liquid acids in any volume for descaling or derusting, write for Bulletin 36. It will open your eyes to real economies and improvements in your operations.

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In Canada — Magnus Chemicals, Ltd., Montreal.
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Magnus
CLEANERS • EQUIPMENT • METHODS

erational efficiency is attributed to the process of Activanium Blending, which involves the use of several energizing agents in Nu-Black. These several energizers are said to be chosen and blended with end application in mind. Literature is available on request.

Surface Conditioning and Pickling Agents

Nielco Laboratories, Dept. MF, P.O. Box 4703, Detroit 19, Mich.

This firm announces two new products for conditioning the surface of metals prior to painting or plating. One product is an acid type material for ferrous base metals, claimed to do a complete job of oil removal and pickling without hydrogen embrittlement or excessive solution of the metal. The other product is alkaline, for use with copper-base alloys and copper plated steel, that is also a one-bath treatment for cleaning and oxide-removal.

Ferroniel 985, for steel, is claimed to permit direct zinc plating of cast and malleable iron and to activate buffed nickel plating for re-plating. The material is said to give off no corrosive fumes, is harmless to workmen, and can be left on the parts without danger of further rusting.

Nielco 921-T, for copper alloys, is a one-tank soak cleaner and scale and oxide remover. It is used boiling, and parts cleaned in this material are claimed to resist oxidation and keep parts in good condition for plating for several days after treatment.

Complete details are available.

New Hard Finishes for Aluminum

Aluminum Company of America, Dept. MF, 801 Gulf Building Pittsburgh 19, Pa.

New hard coatings for aluminum, where high resistance to abrasion is desired, are being released to licensees by *Aluminum Company of America*. These coatings have special value where hard, long-wearing surfaces coupled with light weight are essential, as in surfaces subjected to abrasion or erosion. They have been used extensively in aircraft equipment and orthopedic appliances.

The new wear-resistant finishes are anodic oxide coatings which form an integral part of the metal they protect. Intrinsically hard, aluminum oxide coatings cannot be chipped or flaked from their parent metal, and the newer types afford superior resistance to abrasive action. Some of these wear-resistant finishes are made by the well-known Alumilite process.

Alcoa has also acquired the U. S. patent rights to the *Martin Hard Coating* for aluminum from The Glenn L. Martin Company, of Baltimore. The MHC finish is similar to the Alumilite coatings in hardness and structure.

The *Glenn L. Martin Co.* reports that the MHC finish has been used successfully in the solution of problems of wear, abrasion, heat erosion, and corrosion in such diversified articles as gears and pinions, turbine impeller blades, nozzles, the leading edges of high-speed airfoils, and leg braces for paraplegics.

MHC-finished aluminum has been applied to many parts of Martin aircraft, such as pistons, cylinders, jackscrews, walkways, door mechanisms, and other applications in which the finish has permitted aluminum-for-steel substitutions which have cut weight and operating costs.

Shorter Deburring Time

Blue Magic Chemical Specialties Co,. Dept. MF, 2135 Margaret St., Philadelphia 24, Pa.

A newly developed deburring and barrel finishing compound from the Blue Magic laboratories is now available. This No. S-12 Compound is claimed to reduce deburring time by as much as 75% to 90% and to cut deburring and finishing time in half or less, also to produce absolutely uniform radii on parts such as bearing races and retainers.

Another important advantage claimed for No. S-12 Compound is that it is a good temporary rust inhibitor. A load of parts, deliberately dumped at the end of a deburring cycle, without rinsing or drying, and left exposed for three hours showed no indications of rust formation, according to the firm.

The compound is a highly concentrated, non-dusting, granular composition, white in color and is used in small quantities, generally only ½ lb. to 1 lb. per load in a 32″ x 30″ barrel. The manufacturer offers laboratory facilities also free samples of S-12 Compound for steel deburring and finishing test runs.

New No-Prep Vinyl Primer

U. S. Stoneware Co., Dept. MF, Akron, O.

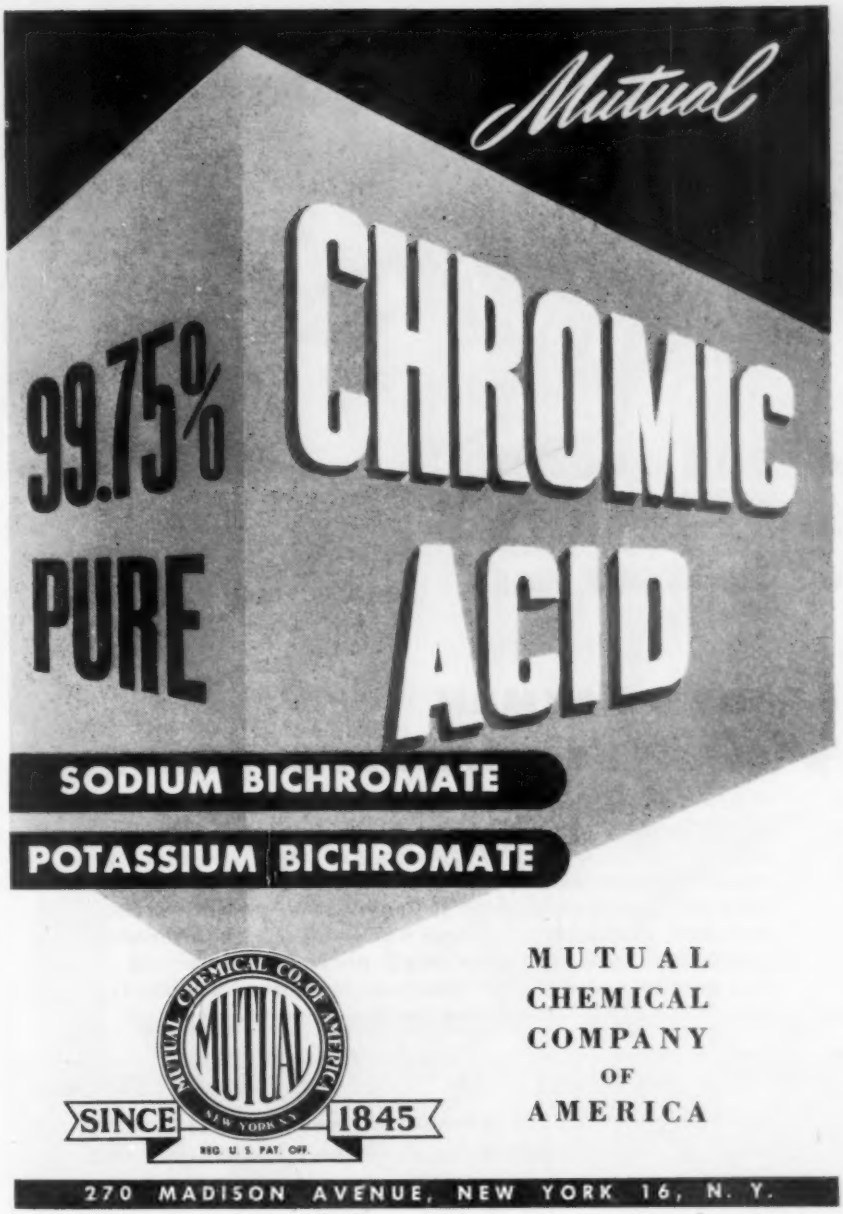
The above company recently announced the availability of a new vinyl primer, Tygorust, specifically developed for use on rusted steel surfaces without the necessity for previous preparation.

Said to be so new and unique that some of its ingredients have just become available, Tygorust is easily applied by brushing, spraying, or dipping; dries hard and can be overcoated in a matter of minutes; adheres tenaciously to rusted steel, damp or dry; and, can be used with any type of finish coating—particularly vinyls.

Under exaggerated test conditions, Tygorust has been brushed and sprayed on damp rusted panels, and also brushed on dripping wet rusted panels, with completely satisfactory results, it is claimed. Dry, rusted steel has been successfully primed without even wire-brushing, according to the firm. For maximum results, of course, the surface must be free of grease and oil and loose scale should be removed.

Despite the fact that Tygorust is fast drying, it can be applied to old, oxidized paint films (bituminous coatings excepted) without lifting or bleeding and can be safely overcoated with vinyl, nitro-cellulose, alkyd and oil based finishes, it is claimed.

Indication of the adhesive and rust-inhibitive properties of Tygorust, finish coated with Tygon paint, is available in the results of 120 hour salt spray tests, wherein previously rusted steel panels showed no evidence of rust creepage along the scorings. Complete details may be obtained.



Preparatory Treatment for Aluminum

Silver Star Chemical Corp., Dept. MF, 58 Watts St., N. Y. 13, N. Y.

In announcing Starcote, a new conversion treatment for aluminum and its alloys, the above firm claims that Starcoting affords superior corrosion resistance and perfect organic coating adherence.

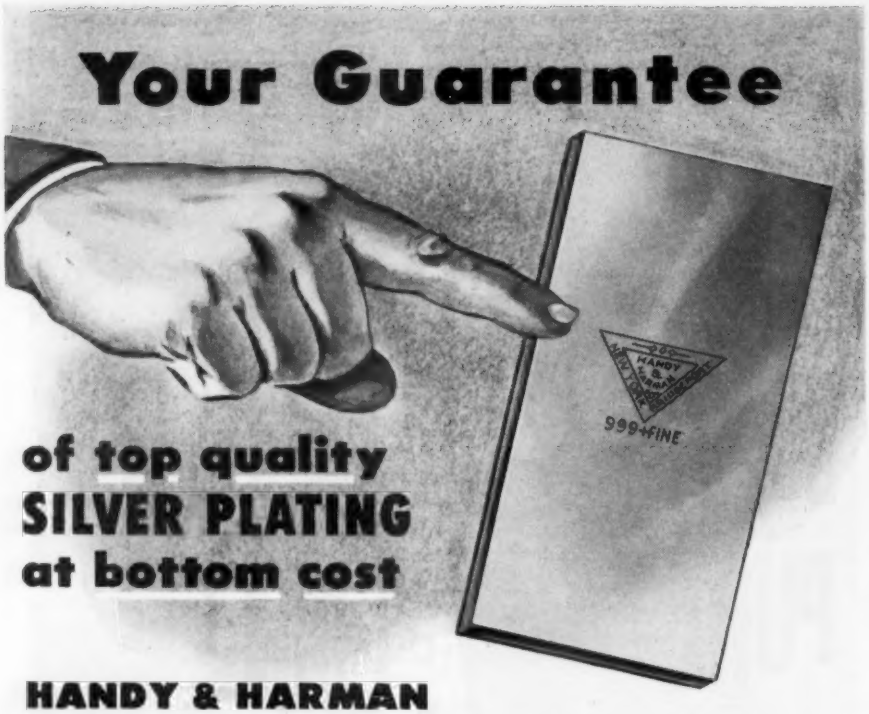
Said to be inexpensive and easy to use, the Starcote bath is maintained by a simple titration. Work may be handled in iron containers or racked. This versatile material may be applied by dipping or by a conventional alkaline washing machine on a production line basis.

For purposes of identification the coating may be colored with certain dyes. Complete details on request to the above address.

Cleaner and Neutralizer

Patterson Wells Corp., Dept. MF, Madison, N. J.

This firm announces the development of a new type of oil and grease remover combined with a neutralizing agent that permits both operations to be conducted in a single tank. The material is especially useful in acid pickling operations it is claimed, making it possible to first remove all oil and grease to permit effective pickling, then neutralizing the parts after pickling to prevent rusting. The manufacturer claims that the material is free-rinsing and ready-wetting, and greatly



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When you see that triangle and "999+FINE" mark on a silver anode you can be sure of three things about that anode—(1) it is free of every trace of impurities that can cause plating troubles—(2) it measures up to highest standards in fineness—(3) it has physical properties that are ideal for plating . . . And when you *use* those anodes you can be sure of smooth going, profitable production of top quality plating. Next time you buy silver anodes, try the "999+FINE" brand and see the difference.

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prolongs the life of pickling baths. One of the features claimed for this material is its non-sludging characteristics, eliminating the need for frequent dumping of the cleaning tank.

Complete information may be obtained by writing to the above address.

Reconditioning Valves and Fittings

Magnus Chemical Co., Inc., Dept. MF, South Ave., Garwood, N. J.

In the plants of a great many major industries the reconditioning of valves and fittings is an important part of the maintenance program. Not only do the valves vary greatly in size and type, but effective reconditioning depends to a large extent on the deposits left by processing, which first have to be removed. These deposits consist of oil, paint, lacquer, carbon and, on valves and fittings from high temperature spots, stubborn carbonized oil deposits varying from lacquer-like coatings to heavy coke-like deposits.

Caustic solutions had been found to be most effective in removing most of these deposits, though some did not respond, but the hazards of using strong caustics and the unpleasant fumes involved, added to the fact that cleaning was not complete in any case, led to experimenting with various types of industrial cleaners. After a thorough investigation, involving the testing of a great many compounds, a heavy duty alkaline cleaner, Magnus 61RS, was found to be the most satisfactory, both from the viewpoint of effectiveness of cleaning and of cleaning costs.

This cleaner is said to have a strong alkaline cleaning action, but without fumes and free from the hazards of caustics.

Some fittings are thoroughly clean in 30 minutes. They are removed and processed. Others may take another 30 minutes, but with certain exceptions, one hour is enough for most of the valves and fittings.

On those valves and fittings where a scale condition exists, or where it is known that an acid treatment is necessary to dissolve deposits, another Magnus product, D-Scale-R is used. This is an inhibited acid cleaner in which the parts are soaked to remove the deposit. Procedure is to give such parts the regular alkaline cleaning treatment and then to clean with the D-Scale-R solution at 8 ounces per gallon of water heated to 130°F. for about 30 minutes, or until the deposit is dissolved. The parts are then water rinsed and given a brief dip in the regular 61RS solution to neutralize any residual acid and finally rinsed with water.

These cleaning procedures apply to the valves and fitting of most industrial operations. None of the cleaners used has any harmful action on steel, stainless steel, cast iron, brass or bronze, and cleaning effectiveness is the same in most cases, it is claimed. There will be special cases where one or more specialized cleaners might be necessary to take care of certain deposits, but by and large the valves and fitting of chemical plants, paper mills, iron and steel mills, oil refineries, food factories, smelting and refining plants, leather producers, paint and varnish plants, textile mills, etc., will be economically and effectively cleaned by these methods, according to the above firm.

Etch for Aluminum

Silver Star Chemical Corp., Dept. MF, 58 Watts St., N. Y. 13, N. Y.

A new compound for the controlled etching of aluminum and its alloys has been developed by the above firm.

Star Etch is claimed to eliminate the problems of foaming, sludging, and hard scale formation, while sharply reducing the hazards associated with conventional etching. Production of a uniform controlled etch is possible by either dipping or mechanical spray-

ing. The bath is easy to operate, easy to maintain and economical to users, according to the firm.

Appreciable savings in labor, maintenance and heating costs may be realized, and it eliminates costly shutdowns to remove stone-like deposits from tanks and heating coils. Complete details are available on request to the above address.

Brass Plating Maintenance Compound

True-Brite Chemical Products, Inc., Dept. MF, P.O. Box 31, Oakville, Conn.

Brass plating has always been an art, with the plate subject to sudden and unforseen changes in color. The solution is only kept in working condition by the constant attention of the plater. Brass plating has been neglected as a common method of application by electroplating as a result of this difficulty in maintaining proper color. True-Brite Brass Maintenance Solution was especially developed to eliminate this variation and provide consistent results.

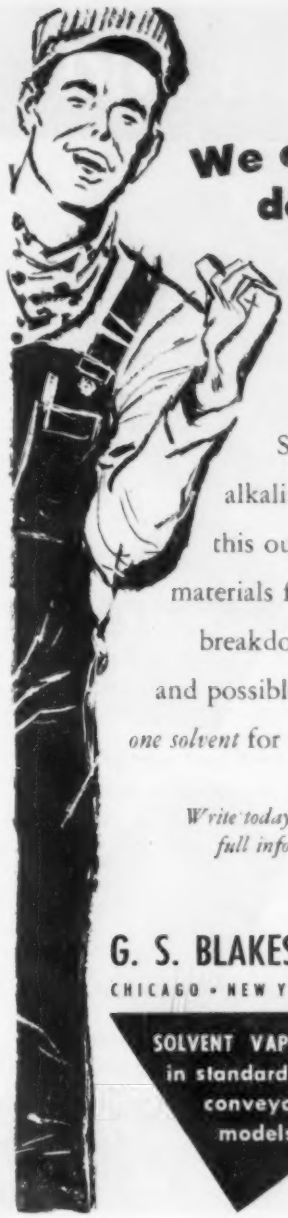
True Brite Brass Maintenance Solution is not a corrective, or merely an addition agent. It is a balanced compound of all materials necessary for the daily maintenance of the brass plating solution. By its continued use the solution will stay in good operating condition with infrequent attention and without most of the usual deposits of sludge in the bottom of the tank, it is claimed. No additions of cyanide, either sodium, copper or zinc, are necessary except at long intervals as determined by analysis. While True Brite Brass Maintenance Solution is not a brightener, a brass plating solution kept in good condition will plate practically bright and will maintain the luster of the base metal even up to very heavy deposits.

Complete details are available from the above address.

Leather Polishing and Buffing Wheels

Stuart C. Olsen, Dept. MF, West Road, Norfolk, Conn.

This firm announces a complete line of walrus, bullneck, and sheepskin leather wheels especially suited to the very highest requirements of the polishing and buffing trade. Used for many years in the cutlery industry for producing the very best luster obtainable, these leather wheels have long life and maximum serviceability. Available in various sizes, stitchings, and arbor hole sizes. Write to the above address for complete details and prices.



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Highest Stabilized Degreasing Solvent—BLACOSOLV is stabilized not alkalized—Years of research have produced this outstanding solvent. Contains no alkaline materials for the purpose of neutralizing acid *after* breakdown. Stabilizers prevent breakdown and possible acid formation. Blacosolv is the *one solvent* for *all metals* or *combination* of metals.

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Availability of Scarce Plating Chemicals Announced

Chemicals Div., Octagon Process, Inc., Dept. MF, 15 Bank St., Staten Island 1, N. Y.

High purity nickel sulfate and zinc cyanide, materials of scarce supply in the plating industry, are now offered for immediate shipment by the above firm. Octagon is importing nickel sulfate which is claimed to exceed the American material in quality. These high purity standards make the material particularly valuable in bright nickel plating baths. The attention of automotive and household appliance manufacturers are invited to this new source of nickel sulfate for electroplating.

Octagon also announces the availability of a large supply of pure zinc cyanide, free of lead, said to be especially developed for electroplating. This is also an imported material. Due to its excelent quality, it is suitable for use in bright plating baths, according to the firm. Extensive stocks are maintained at Octagon's warehouse.

For further information and prices on these chemicals, please write to the above address.

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WOOD TUMBLING BARRELS

- BEST GRADE MAPLE or other woods to specification
- GREATER THICKNESS for longer life
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A SIZE AND SHAPE FOR EVERY PURPOSE

8 to 14 sided barrels — 14" to 38" in diameter
Round barrels — all sizes
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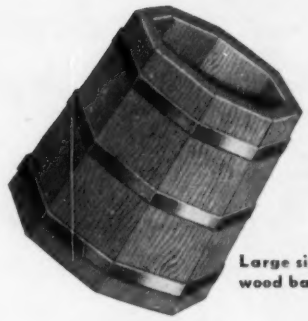
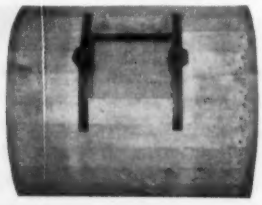
SPECIAL BARRELS

Where finishing specifications call for a different type barrel, Henderson Bros. is prepared to construct special equipment for practically any purpose.
ALSO barrels in steel, stainless steel, brass, Monel Metal and other alloys.



Large sided wood barrel

Small sided wood barrel



Horizontal wood barrel

Round wood barrel

SINCE 1880 DESIGNERS and BUILDERS of Tumbling Equipment

THE HENDERSON BROS. COMPANY
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Manufacturers' Literature

Buffs and Polishing Wheels

F. L. & J. C. Codman Co., Dept. MF, Rockland, Mass.

A new catalogue just issued by this firm, makers of high quality buffs for over 55 years, illustrates the many types of non-fray buffs and wheels manufactured by them. Contact wheels are available in 5 different degrees of hardness, and in many diameters and face thicknesses. Conventional buffs are made in all standard and many special sewings. One of Codman's new developments, the Blu-Sisal buff, is featured. This type of sisal buff is specially designed and treated to hold compound more effectively than ordinary sisal buffs, and in addition is non-fraying and fast cutting. Copies of this illustrated booklet are available by writing to the above address.

Barrel Finishing Compound

Blue Magic Chemical Specialties Co., Dept. MF, 2135 Margaret St., Philadelphia 24, Pa.

Bulletin No. 1 describes new chemical in highly concentrated paste form for descaling, roughing, deburring, cleaning, and finishing brass, bronze, copper, gold, silver and certain other non-ferrous parts by barrel tumbling. Gives case histories of time savings and improved product quality. Offers free working samples and laboratory facilities for test runs.

Complexing and Chelating Agents

Bersworth Chemical Co., Dept. MF, Framingham, Mass.

This firm has issued a booklet describing the uses of a wide range of chemical complexing and chelating materials developed by this firm. These versatile materials are just now coming into the plating and finishing field, and should find a wide field of application due to their unique properties. What these materials are and what they can do are simply described, and a number of typical applications are given. Among these is an immersion process for copper plating steel that provides a smooth bright, and highly adherent coating useful for lubrication or as a preliminary plate for other subsequently deposited metals. Copies of the book may be obtained by writing to the above address.

Neoprene Protective Coatings and Linings

Gates Engineering Co., Dept. MF, P.O. Box 1711, Wilmington, Del.

This firm has just issued several data sheets proclaiming the advantages and applications for neoprene protective coatings and linings in the chemical industry. Available as liquids these neoprene materials can be brushed or sprayed onto steel tanks, ducts, etc. to provide long-lasting protection against practically all industrial corrosives. The material is also available in uncured sheet stock that can be readily cured after application in a warm air atmosphere. Copies of these data sheets may be obtained by writing to the above address.

Carbon and Graphite Brick

National Carbon Co., Div. of Union Carbide and Carbon Corp., 30 East 42nd St., New York 17, N. Y.

A revised Catalog Section covering "National" carbon and graphite brick, for application in the chemical, processing and metallurgical industries has been announced by the above firm.

The Catalog lists the principal features of carbon, graphite and impervious graphite, and some typical metallurgical and chemical applications. Complete tables are given for brick sizes, shapes, grades and physical

properties, with special information on graphite beams, blocks, plates and rods in sizes up to a maximum of 24″ x 30″ x 180″. Suitable cements are available for use with both the regular grades and the impervious types of carbon and graphite brick, including scored carbon brick in applications requiring maximum strength of bond.

To meet the need for an impervious, corrosion-resistant material, "Karbate" Brand Impervious Carbon and Graphite in the standard brick shapes and sizes are shown in convenient tables.

Bantam Water Demineralizer

Barnstead Still & Sterilizer Co., Dept. MF, 170 Lanesville Terrace, Forest Hills, Boston 31, Mass.

Bulletin No. 124 describes Barnstead's convenient Water Demineralizer for laboratories. This demineralizer connects directly to any water supply and delivers the demineralized water in continuous flow from 5 to 8 gallons per hour. Its seven new features, including the new direct-reading type meter, are completely described in Bulletin No. 124 which may be obtained by writing.

Corrosion-Resistant Floors

U. S. Stoneware Co., Dept. MF, Akron 9, O.

Bulletin AB17. "*How to Build Corrosion Resistant Floors*" describes in detail how to construct acid-proof brick floors. The new Bulletin describes the uses of acid brick, the application of different types of cement, shows detailed drawings of various types of floors, as well as actual installation photos. This book is designed for and directed to the engineers and construction men who are faced with corrosion resistant flooring problems. Complete installation instructions, and answers to typical questions on flooring is also covered in this new 16 page 2 color Bulletin.

This Bulletin is free on request. Requests should be made to the above address.

Water Conditioning Booklet

Elgin Softener Corp., Dept. MF, Elgin, Ill.

A new 20-page Bulletin 611 covers the various methods of conditioning water and the purposes served by each. It features an improved water softener of "double-check" design which is claimed to give up to 44% greater capacity and guard against costly loss of zeolite. This booklet tells how to make any water softener deliver from three to ten times more soft water. Describes a deionizer of single-tank design which produces ultra-demineralized water at a fraction of distillation or evaporation cost. Chemical feed, zeolite—post treatment, zeolite—alkalinity neutralization, and split-stream de-alkalization systems for boiler, process and general water conditioning purposes are covered. Sections of the bulletin are devoted to latest type filters, purifiers, degasitors, zeolites, ion exchange resins, and water treatments for all purposes. Copy of booklet will be sent on request.

LOWER COST
FINISHING
WITH
Hammond
JUNIOR AUTOMATIC
POLISHING AND
BUFFING
MACHINES
Users of Hammond Junior Automatics report 3 to 7 times faster finishing than hand methods. The Operator merely loads and unloads the machine, result . . . . faster, better and more uniform finishing, more pieces per hour with less operator fatigue.
SEND SAMPLES: Send us one finished and several rough samples. You will receive a complete Engineering Report and Production Analysis without obligation.
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of KALAMAZOO
Good Machinery Since '82
Hammond Machinery Builders INC.
1601 DOUGLAS AVENUE ★ KALAMAZOO, MICHIGAN, U. S. A.

Water Demineralizing

Penfield Manufacturing Co., Inc., Dept. MF, Meriden, Conn.

This concern, with over 10 years experience designing and manufacturing ion exchange systems for industry, has just published a new catalog sheet giving a clear and concise description of their new Mono-Bed Demineralizer. Included in this catalog sheet are: (1) a picture of the unit; (2) a diagram with parts lettered and identified; (3) a description of the parts; (4) a specifications chart; and (5) a performance chart from which potential users can estimate their operating costs.

Penfield Mono-Bed Demineralizers

STOP OFF

FOR

ALUMINUM

A new Stop Off lacquer for use on Aluminum in selective anodizing, or in chemical treatments of this metal.

BUNATOL No. 796-CC Black is a quick air dry liquid that flows out easy and covers well. Air dries in 30 minutes to form a very adherent coating that is not affected by anodizing solutions or chemical solutions. Edges may be trimmed to a hair line, or lettering or designs may be exposed, and hold the edge perfectly. Applied by brush, spray or dip.

A single coat is all that is required for a good Stop Off film. This special lacquer covers a lot of surface, making it an inexpensive item to use in production. After running, the coating removes easily with a quick wash in Solvent. The Aluminum does not need any preliminary treatment other than removing surface dirt and grease, and must be dry. Just apply Stop Off, air dry and run the work.

No. 796-CC Black is made for use on Aluminum and of course does a better job. Time is saved — rejects eliminated and cost reduced. If your anodizing requires stopping off, get the facts about BUNATOL and a working sample. A note on your letterhead is all that is necessary.

BUNATOL

Manufactured by

NELSON J. QUINN COMPANY

TOLEDO 7, OHIO

operate on what is claimed to be the most efficient deionizing technique known—intimately mixed anion and cation resins in a single unit tank. The raw water passes through the unit only once yet comes out with a mineral content of virtually zero—resistances have been reported as high as 20,000,000 ohms per centimeter, according to the firm.

Available in flow rates from 10 to 10,000 g.p.h., the national average chemical costs for operating Penfield Mono-Bed Demineralizers is less than 15c per 1,000 gallons. No heat or steam power is ever required and regeneration of the resins is accomplished by simple gravity and displacement methods.

Selenium Rectifier Catalog

Bart-Messing Corp., Dept. MF, 229 Main St., Belleville 9, N. J.

The new illustrated catalog, "A Guide To Better Plating Power," has been announced as available by the above firm.

The complete line of Sel-Rex selenium rectifiers is presented with descriptions, drawings and photographs.

The selection of the proper D.C. power for the maximum in low cost efficiency, is thoroughly discussed in this booklet.

All types of rectification to provide direct current power for every electroplating, electropolishing, electrocleaning and electrochemical need is clearly described.

BUSINESS ITEMS

Robillard Joins Exolon Co.

The Exolon Co., Tonawanda, N. Y. announces the appointment of *Harvey J. Robillard* as Ceramic Engineer. Mr. Robillard served as a fighter pilot with U.S.A.A.F. in ETO. After graduating from Alfred University in 1948 he joined the Bay State Abrasive Products Co. as a Ceramic Engineer. Much of his time at Exolon will be devoted to assisting companies in their use of Exolon abrasive and refractory products.

Mr. Robillard is married, has three children and lives at 20 Eton Lane, Snyder, N. Y.

Karl Ehrlich Moves to New Location

The *Karl Ehrlich Co.*, manufacturers of high grade cotton buffs, buffing compounds, and brushes of all types, announces the moving of the firm to new quarters at 7823 Woolston Ave., Philadelphia 19, Pa. The telephone number is LIvingston 86926.

This firm was formerly located at 1828 W. Tioga St., Philadelphia, Pa.

CORRECTION

In the February issue, page 101, the photographs of *Mr. Lloyd A. Dunn*, of *Wyandotte Chemicals Corp.*, and *Mr. Fred W. Arndt*, of *Heil Process Equipment Co.*, were accidentally reversed. The correct pictures of these two men are published herewith. We regret this error.

Lloyd A. Dunn

Fred W. Arndt

Northwest Chemical Co. Announces Appointment of Alert Supply Co. as Western Representative

Mr. H. J. McCracken, president of *Northwest Chemical Co.*, 9310 Roselawn Avenue, Detroit 4, Mich., has announced the recent appointment of the *Alert Supply Co.*, Los Angeles, California, as Western Representative. *Alfred E. Perkins*, president of this organization, has included in his background thirteen years' experience selling for L. H. Butcher Co., of Los Angeles, metal plating specialists. Secretary - Treasurer of the concern, *Arthur D. Gaskin*, graduated with a degree in Chemistry Research from Oxford University. He has since gained a wealth of experience with such companies as Bass & Company, one of England's leading brewers, Bruce Products in Howell, Mich., makers of buffing compounds, H. A. Montgomery, Detroit, manufacturers of special lubricants and L. H. Butcher, where the partners became acquainted. The Alert Company's transfer of operation to its recently completed headquarters in the Central Manufacturing District in Los Angeles makes available a combination of the most modern facilities for extensive and efficient representation in this territory.

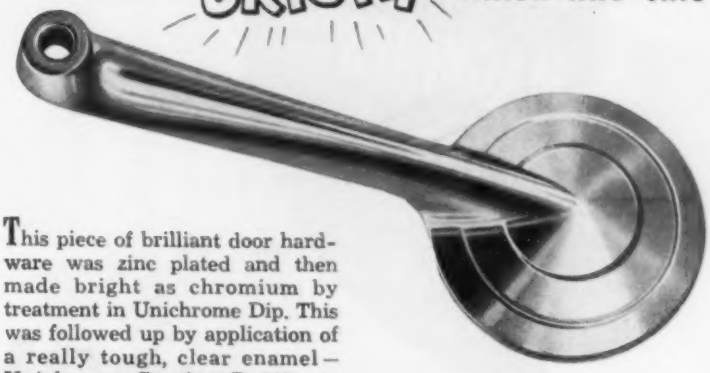
Hooker Honors Veteran Employees

Hooker Electrochemical Co., Niagara Falls, presented engraved gold watches to 136 employees, both active and retired, who were in the service of the company for 25 years or over.

Presentation on behalf of the company was made by *Bjarne Klaussen*, executive vice-president who has been with Hooker for 35 years. The group represented 5,134 years of service, an average of 32 years.

Unichrome CLEAR Enamels

add durability to a BRIGHT finish like this



This piece of brilliant door hardware was zinc plated and then made bright as chromium by treatment in Unichrome Dip. This was followed up by application of a really tough, clear enamel—Unichrome Coating B-115—to provide outstanding resistance to corrosion, handling and exposure.

This same, service-proved, non-yellowing baking synthetic is also ideal for use on chromium which has been deposited over thin nickel or no nickel at all. Here, too, you'll get the extra protection and adhesion needed for a dependable, durably bright finish.

Also available are durable, *light-fast* Unichrome Coatings to simulate gold, brass or copper colors on polished stainless steels and chromium.

Need help on a combination finish for your product? Write the Company that knows *metal* finishes as well as their requirements in *coatings*—United Chromium.

UNICHROME COATINGS for METALS

METALLIC • ORGANIC • PROTECTIVE • DECORATIVE

Products of UNITED CHROMIUM, INCORPORATED, 100 E. 42nd St., New York 17, N. Y.

Waterbury 20, Conn. • Detroit 20, Mich. • Chicago 4, Ill. • Los Angeles 13, Cal.

In Canada: United Chromium Limited, Toronto, Ont.

Zinc Institute to Hold Annual Meeting

The American Zinc Institute announced that its Thirty-Fourth Annual Meeting will be held at the Hotel Statler, St. Louis, Mo., on Monday and Tuesday, April 21 and 22.

Present plans provide for a full two-day program with a morning and afternoon session scheduled for both Monday and Tuesday.

Qualified speakers from Washington and from the industry will report on the general outlook for metals and the zinc supply and requirements picture. Mine development and production expansion at home and abroad will be thoroughly covered by a special panel of mining men. Plans are under way to add several special features to the program relating to topics of vital interest to all concerned.

The annual dinner and smoker will be held on Monday evening, April 21.

American Wheelabrator Announces Promotion

American Wheelabrator & Equipment Corp., Mishawaka, Ind., manufacturer of dust collectoss and abrasive blasting equipment, announces the promotion of *Andrew B. Stevens* to the position of Assistant Factory Manager. He has held the position of Supervisor of Production Control and

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THE ALVEY-FERGUSON CO. 201 Disney St. Cincinnati 9, Ohio
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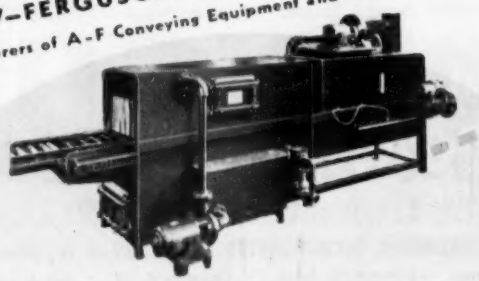


W. C. Van Keuren

the Technical Service Dept. Mr. Hastedt has represented Wyandotte in trade association and company organization meetings in many parts of the country and is widely recognized for his sound, aggressive and helpful talks at these meetings.

Willard C. Van Keuren has been a sales and service supervisor in Wyandotte's Boston district since 1945. He brings to Wyandotte's Philadelphia district a broad and practical experience in the application of cleaning, sanitizing and washing compounds.

G. T. Robinson, former Chicago manager, resigned to become general manager of a creamery company in Cleveland, Ohio, where he resided for 17 years.

Joseph Hickson, former Philadelphia manager, resigned to found his own business in the Philadelphia area.

L. F. Miller Elected Osborn Director

The election of *Leon F. Miller*, Vice-President in charge of sales and engineering of the Machine Div., as a Director of *The Osborn Manufacturing Co., Cleveland*, was announced recently by *Norman F. Smith*, President.

Mr. Miller, a pioneer in foundry operations, celebrated his 23rd year with Osborn last month. He joined the company January, 1929, as a draftsman after having attended Case Institute of Technology in Cleveland.

His rise in this company is indicative of his knowledge of the foundry industry and his resourceful leadership which has done a great deal toward establishing Osborn in the industry.

In 1935 Mr. Miller was promoted to Sales Engineer. After 10 years of

Stores with the company for the past six years.

Hastedt and Van Keuren New Wyandotte Chemicals District Managers

Howard E. Hastedt and *Willard C. Van Keuren* recently became managers of Wyandotte Chemicals Chicago and Philadelphia districts. The appointments were made by *Robert L. Reeves*, general manager of The *J. B. Ford Div.* of the Wyandotte organization.

Howard Hastedt joied Wyandotte Chemicals in 1945 as a sales and service supervisor in Pittsburgh, Pa. In 1950 he was transferred to the home office staff, in charge of a section of

H. E. Hastedt

Leon F. Miller

traveling, he was made Sales Manager in March, 1944. He was elected Vice-President, January, 1950.

He is a member of the American Foundryman's Ass'n., having served on the Board of Directors, and a member of the Cleveland Athletic Club.

Detrex Solvent Equipment Sales Highest Since 1947

The increase in the rate of solvent degreasing equipment sales for 1951 is four times that of 1947, according to figures made public by the *Detrex Corp.*, Detroit 32, Mich., one of the world's leading manufacturers of chemicals and equipment for industrial production cleaning.

The rapid increase in the adoption of degreasing as a metal cleaning process by both civilian and defense industries is due, according to a Detrex spokesman, to the over-all speed and efficiency of degreasing in all forming, fabrication, and finishing operations.

To cover the pyramiding demands industry has placed on trichlorethylene degreasing solvent supplies, further increases in solvent production capacities are scheduled by Detrex for 1952.

Cowles Appoints Clabaugh to Technical Service

Cowles Chemical Co., Cleveland, O. announces the appointment of *Carl C. Clabaugh* as Cowles technical man in the Philadelphia-Eastern Pennsylvania territory. It was pointed out that this new appointment again expands Cowles coverage of the metal cleaning market.

Mr. Clabaugh served the industry previously as a chemist for a large electrical products company, and for the past five years as a technical sales representative serving plating and other finishing shops in the Cincinnati area. This experience plus an extensive product familiarization program at Cowles makes Carl well qualified to serve the metal working industry in Pennsylvania with Cowles metal cleaners.

Carl C. Clabaugh

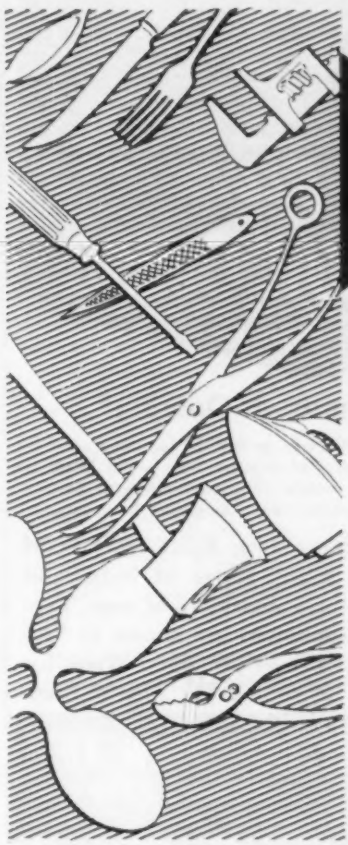
Holt to Head Diamond Alkali Chlorinated Solvents Sales

Diamond Alkali Co. announced that *L. J. Polite, Jr.*, long active in chlorinated solvents sales, has been transferred to the company's Organic Chemicals Div.

Mr. Polite will be attached to the sales staff of Kolker Chemical Works,

EXTREME *Versatility*

for Lower Finishing Costs



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SURFACE FINISHING MACHINES

A versatile Clair Surface Finishing Machine may be the answer to economical, production-quality surface finishing of your products. Combining the "touch" of the old time craftsmen with extreme versatility and high speed production, Clair Surface Finishing Machines are soundly engineered and ruggedly built.

By cooperative counsel between your engineers and Clair designers, custom surface finishing equipment may be developed to give maximum efficiency and economy on your metal finishing operation.

May we show how Clair Surface Finishing Machines can save money for you? Write for technical data.

CLAIR MANUFACTURING CO., INC.

SPECIALIZED MACHINE EQUIPMENT FOR GLAZING AND POLISHING OPERATIONS

OLEAN, N. Y.

Shipped Complete, Tested, Ready-to-Operate!

At left: Electrically heated, automatically controlled oven for baking insulating varnish on coils, stators and other parts at Internat'l. G. E. Service Shop, Mexico City.

At right: Steam heated, 22 foot long oven for removal of moisture from paper filters used in acetate yarn manufacture at Tennesse Eastman Corp., Kingsport, Tennessee.

READY TO USE when they reach your plant, production-size ovens are built, tested and shipped complete from the KIRK & BLUM plant. Your production through the oven starts just as soon as necessary connections are made . . . there's no tie-up for erection, testing or adjustment in your plant. You save time, money and avoid production delays.

From mammoth conveyor ovens for high production to the smallest of laboratory units, KIRK & BLUM builds many types of industrial ovens for a multitude of uses. Typical installations are shown in "Industrial Ovens" Booklet. Write for your copy today. The Kirk & Blum Mfg. Co., 3159 Forrer Avenue, Cincinnati 9, Ohio.

KIRK AND BLUM
INDUSTRIAL OVENS

Inc., Newark, N. J., a Diamond subsidiary specializing in organic chemicals for industry and agriculture.

Diamond's sales and service to chlorinated solvents customers will continue under the direction of *C. M. Holt*, product sales manager for chlorine and its derivatives.

Industrial Washing Machine Exclusive Distributorship Awarded

Effective immediately, the appointment of *Industrial Systems Co.*, New Brunswick, N. J., as exclusive distributors for its complete line of washing and metal treating machines has been announced by *Industrial Washing Machine Corp.*, New Brunswick, N. J. The move, which consolidates the manufacturer's sales activities, makes Industrial Systems Co. sole sales agents on both the national and international levels. The sales company also acts as exclusive distributors of Industrial Systems Conveyors.

William P. Drake, Pennsalt Vice-President, Named Director of OPS Div.

William P. Drake, Vice-President of the *Pennsylvania Salt Manufacturing Co.*, Philadelphia, has been named Director of the Rubber, Chemicals and Drugs Division of the Office of Price Stabilization, OPS Director *Michael V. DiSalle* has announced.

The new director succeeds *Thomas H. McCormack*, who is returning to his duties as Director of Sales of the Grasselli Chemicals Division, E. I. du-Pont de Nemours & Co., Wilmington,

Wm. P. Drake

Del. Mr. Drake will serve as director until next July 1.

As Pennsalt Vice-President in Charge of Sales, Mr. Drake has headed the chemical company's nine sales departments, which serve a great many of the nation's industries. He joined the company in 1934 in its student training course. Then successively, he was a salesman, a manager of sales, and assistant vice president in charge of sales, before his appointment as vice-president in 1949.

Mr. Drake is a member of the Manufacturing Chemists' Association, the American Electroplaters Society, the Armed Forces Chemical Association, the Midday Club of Philadelphia and Psi Upsilon.

Porter-Cable Sells Floor Sander Line

D. J. Ridings, president of the *Porter-Cable Machine Co.*, of Syracuse, N. Y., announces the sale of the firm's floor sanding machine line to *Clarke Sanding Machine Co.* of Muskegon, Mich. The Clarke Sanding Machine Co., established in 1920, has long been a leader in the field of rental floor sanders. The purchase of the Porter-Cable patent rights, tools, and fixtures will broaden Clarke's line so that they will now have a full line of floor finishing and maintenance machines for both the professional and rental dealers.

This transaction will enable Porter-Cable to devote more time to the engineering and distribution of portable electric tools, a field in which they are one of the leaders. In the past three years, Porter-Cable has purchased the assets of three portable tool compan-

ies: *The Unit Electric Tool Co.*, of Syracuse, which manufactured a line of routers, shapers and planes; the *Sterling Tool Products Co.* of Chicago, which manufactured a line of finishing sanders; and the *Johnson Engineering and Sales Corp.*, which manufactured a line of air sanders. All these transactions have been aimed t establishing a prominent lead for Porter-Cable in the portable tool field.

Moving of the assets purchased by the Clarke Company from Syracuse to Muskegon will proceed shortly and it is hoped that they will be completed in 60 to 90 days.

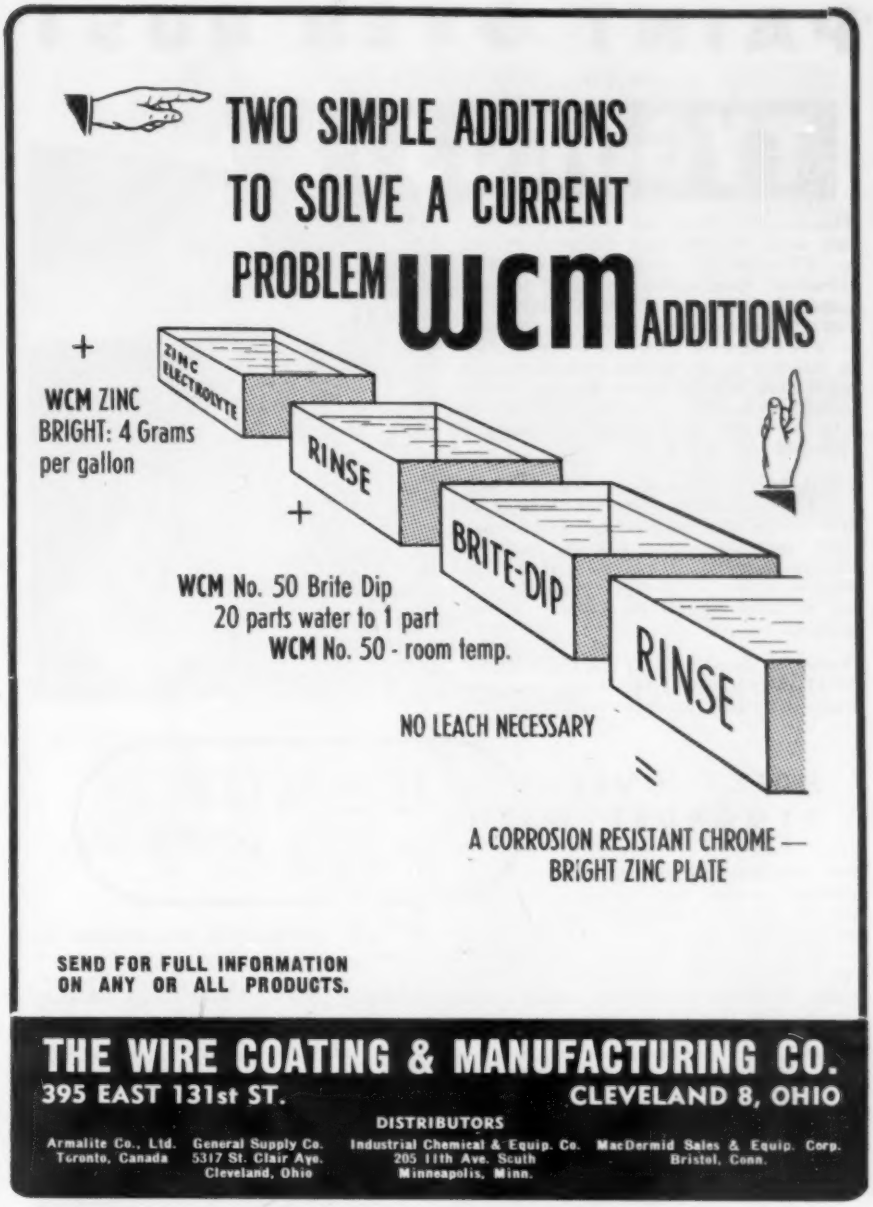
Porter-Cable entered the Floor Machine business in 1928 by acquiring the *Erickson Co.* of New York and since that time has become one of the two leaders in the professional floor sanding machine business.

The transaction was consummated in Detroit with *D. J. Ridings*, president, *L. B. Benham*, vice-president, *J. A. Proven*, vice-president, and *R. C. Tyo*, comptroller, representing Porter-Cable. *E. Cooper*, president, *F. G. Cooper*, vice-president, and *D. F. Jardine*, comptroller, represented the Clarke Sanding Machine Co.

H-VW-M Appoints Chalfant Head of Metal Cleaner Sales

The Hanson-Van Winkle-Munning Co., Matawan, N. J. announces the appointment of *Charles N. Chalfant* as Manager of Industrial Cleaner Sales. The move is designed to offer expanded sales and service facilities to those industries faced with the problem of cleaning metals prior to electroplating, anodizing, painting or otherwise decorating or protecting metals.

Charles N. Chalfant



Chalfant brings to Hanson-Van Winkle-Munning many years of experience in cleaner sales and service engineering, first with the Wyandotte Chemical Co. and more recently with the Optimus Detergents Co. Background in chemical and metallurgical studies was at Carnegie Tech and the University of Pittsburgh.

Lynch Co. Moves to Larger Quarters

A. J. Lynch & Company, manufacturers' representatives and distributors, have just moved into their new location at *1495 Custer Ave., San Francisco, Cal.*, where larger offices and storage facilities afford greater opportunity for service to their customers. A complete line of electroplating and polishing equipment and supplies, including chemicals are handled by A. J. Lynch & Co. under the able supervision of their *Mr. J. R. Pattenger.*

Beitzel Scholarship for 1952 Announced

The 1952 college scholarship for sons and daughters of employees of the *Pennsylvania Salt Manufacturing Co.*, provided by *George B. Beitzel*, company president, was announced recently.

One new scholarship is provided each year to the high school graduate of that year selected as winner of the competition by a board of independent judges. The scholarship provides a grant of $1,200, payable in four an-

PAINT OVER RUST
with
TYGORUST

That's right!! You can paint right over rust with the new and different primer — TYGORUST — and, get excellent adhesion! Specifically developed for use under vinyl based coatings, TYGORUST virtually eliminates surface preparation — dries hard in minutes — covers up to 500-600 sq. ft./gallon — and, is rust inhibitive. What's more, its use is not limited to vinyls — it goes under any type of finish and provides excellent adhesion for all.

TYGORUST successfully primes iron and steel — clean or rusted — wet or dry. It can also be used on wood, concrete and previously painted surfaces (bituminous coatings excepted). It brushes easily — sprays beautifully. It can be over coated in as little as ten minutes.

Write for details, today — try TYGORUST, tomorrow! Give it the toughest tests — actually see how well it works!

PAINT OVER TYGORUST WITH TYGON PAINT

For maximum resistance to corrosive fumes and spillage, use the perfect running mate for TYGORUST — TYGON "Series TP" PAINT. TYGORUST was created for use with TYGON PAINT. TYGON PAINT was created — more than ten years ago — to provide outstanding protection against acids, alkalies, oils, greases, and water. TYGON PAINT is quickly applied — dries fast — forms a tough, smooth, flexible film that's long lasting, easy to clean, and non-flammable when dry.

Use the best defense against chemical corrosion. Use TYGORUST plus TYGON "Series TP" PAINT. Write, right now, for full details and resistance data — ask for Bulletin 720.

PLASTICS AND SYNTHETICS DIVISION

U. S. STONEWARE
akron 9, ohio

345C

nual installments of $300, and may be used at any accredited college or university for specialized study in any course leading to a bachelor's degree.

Winners are selected on the basis of general aptitude and scoring on College Board Entrance Examinations. Applications for the 1952 award were received up to February 1. Awards are made in the early summer, but either mid-year or June high school graduates are eligible to compete.

The 1951 scholarship was awarded to *Joseph Distel*, son of *Mr.* and *Mrs. Francis E. Distel* of Wyndmoor, Pa. Mrs. Distel is employed at Pennsalt's Whitemarsh Research Laboratories. The award winner is attending Villanova College, near Philadelphia, and is reported doing outstanding college work.

Ideal Chemical Makes Changes in Location and Executives

Recently made General Sales Manager of Ideal Chemical Products, Inc. was *Mr. Robert L. Miller*. At the same time the firm announced that they were re-locating at 3813 Hoke Ave., Culver City, Calif. Both the office and factory will be at this address.

S. S. Mitwol Named Chief Engineer of Bart-Messing Corp.

Mr. S. S. Mitwol has recently been appointed Chief Engineer of the *Bart-Messing Corporation*, Belleville, N. J.,

S. S. Mitwol

manufacturers of Sel-Rex selenium rectifiers. Mr. Mitwol has been responsible for many developments in the rectifier industry. He became associated with the company in 1948.

National Hardware Show Announces 1952 Dates

The National Hardware Show has announced that the dates for the 1952 exhibit will be October 6, 7, 8, 9, 10, at Grand Central Palace, New York City.

This is the earliest that the dates for a Show have been announced, but the requests for space for the 1952 *National Hardware Show* have been so great that the management decided to make the announcement at this early date.

The 1951 Show broke many records. Seven hundred nine manufacturers of hardware and allied products used every available square inch of floor space at the Grand Central Palace (192,000 gross square feet). It took five thousand eight hundred ninety-two persons to man the booths of the exhibitors. It was the greatest merchandising event in the history of the Hardware Industry.

Olsen Joins Automotive Rubber Sales Organization

Clifford T. Olsen, metallurgist, has joined the sales force of *Automotive Rubber Co., Inc.*, according to an announcement by *Robert L. Redmond*, Vice-President in charge of sales. He

will work with manufacturers in engineering, installing and placing in operation the company's rubber lined and processed tanks and other industrial equipment.

Mr. Olsen was formerly associated

Clifford T. Olsen

with Hanson - Van Winkle - Munning Company, national jobbers of chemical and plating equipment, at their Mattawan, N. J. plant. He is an engineering graduate of Lafayette College.

7th Annual Industrial Waste Conference at Purdue

The 7th Purdue Industrial Waste Conference will be held on May 7, 8 and 9, 1952. The meetings will be held in the Purdue Memorial Union. There will be approximately fifty papers presented on subjects dealing with industrial wastes and their treatment.

Hotel reservations can be made at the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel and Morris Bryant Hotel. Everyone is welcome. The registration fee will not exceed $10.

Job Plating Industry Advisory Committee

On January 21 the Job Plating Advisory Committee met with officials of the N.P.A. Service Equipment Division to discuss a number of points affecting the industry. As a result of the meeting, the committee recommended that the Government investigate alleged black market activities in nickel, charging that large quantities of nickel are being offered from black market sources. NPA officials asked for further information on these allegations.

Committee members said that the electroplating jobbing industry is composed of around 3,500 firms, the majority of which employ 10 or less men, and that the industry can be maintained on 15 per cent of its base period use of nickel anodes by lighter nickel coating. Jobbers stated, however, that they are not obtaining needed quantities of nickel to operate within the limitations of NPA Order M-80. NPA officials responded that military requirements alone exceeded the entire supply of nickel at present and that electroplating industry demands exceed 1950 base usage.

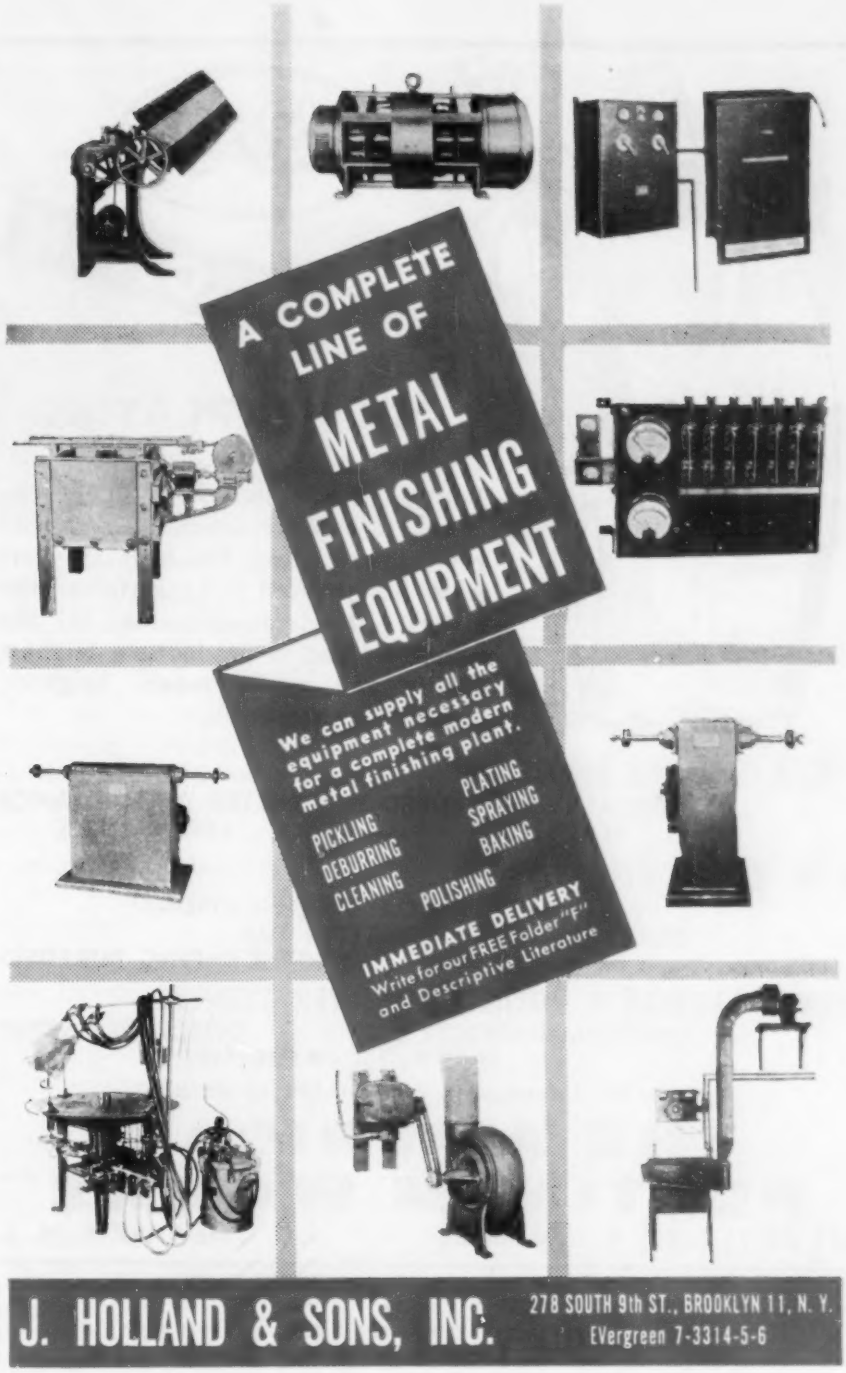
The committee asked that:

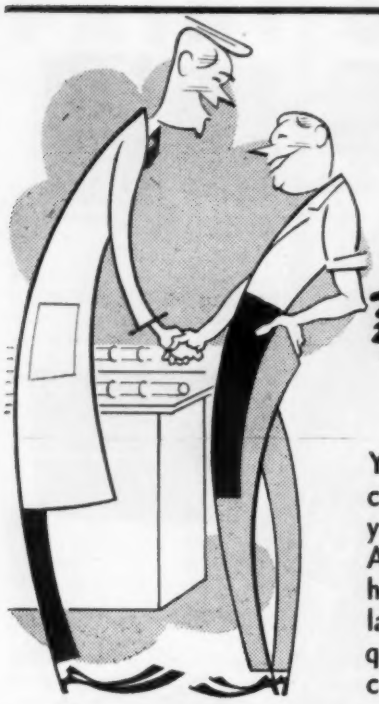
1. M-80 be revised, either for greater liberality or for clarification, in order to place the responsibility for conformity with the order's end-use restrictions upon the contractor ordering the plating service.

2. Schedule 1 of M-80 be revised to permit re-plating services.

3. A study be made of requirements of electroplating jobbers to determine if the industry is being allocated a fair share of supply.

4. DPA consider, on applications for certificates of necessity for tax amortization, the need of plants to expand or acquire machinery to handle new processes required in defense production.





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SPECIALLY DEVELOPED FOR BETTER PERFORMANCE
LESS SCRAP LESS REJECTS

C. P. SILVER NITRATE
MEETS A.C.S. SPECIFICATIONS
OUTSTANDINGLY EFFECTIVE FOR PHOTOGRAPHIC PURPOSES

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Zentner Joins California Alloy Development Firm

Dr. Victor Zentnor, until recently associated with the National Bureau of Standard's Electrodeposition Section, and research chemist on A.E.S. Research Project No. 9, has taken a position as research chemist with *Surface Alloys, Inc.,* of Los Angeles, Calif. While at the Bureau, Dr. Zentnor did some outstanding work on the physical properties of electrodeposited coatings, principally nickel plating. Dr. Zentnor had also served as Treasurer of the Baltimore-Washington Branch of the A.E.S.

Henry Strow Leaves MacDermid

Mr. Henry Strow, for a number of years Chief Chemist of *MacDermid, Inc.,* of Waterbury, Conn. has now left that firm and is now President of *True-Brite Chemical Products Co.,* of Oakville, Conn. This firm manufactures a number of specialty items for the electroplating industry, among which are brighteners for barrel nickel plating and brass plating.

Northwest Chemical Appoints Amedro Representative

The appointment of *Harry Amedro* as Syracuse and Western New York representative has been announced by *Mr. H. J. McCracken,* president of the *Northwest Chemical Co.,* 9310 Roselawn Avenue, Detroit 4, Mich. Mr. Amedro attended Syracuse University where he majored in chemistry while employed at Allied Chemical and Dye Corp. in their Works Laboratory. His further experience included covering New York State as a special representative for General Foods Corp., and

Harry Amedro

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later the same territory plus parts of Pennsylvania for the Du Bois Co., of Cincinnati, O.

Diversey Holds Annual Sales Conference

Dr. H. D. Sharer (center) of U. S. Rubber Co. addressed 300 D-Men of The Diversey Corp., at the organization's 19th annual sales conference in December. On the left is W. E. Noyes, vice-president in charge of sales, and on the right, Chairman H. W. Kochs.

Two new products—Divobond for phosphatizing steel prior to painting, and Diversey No. 101 for electrocleaning brass before plating—were introduced to metal industries sales representatives of The Diversey Corp., at its 19th annual sales conference in December.

R. L. Shannon, head of Diversey's Metal Industries Dept., conducted a comprehensive sales and technical review for his men. Emphasis throughout the sessions was on new and better ways to serve Diversey customers in the various metal industries.

Three hundred D-Men attended the conference, including the entire sales organization of The Diversey Corp. (Canada) Ltd., a subsidiary company.

Outside speakers who presented specialized aspects of selling to the full assemblage were *Dr. H. D. Sharer*, of United States Rubber Co., *R. H. Threlfall*, of Great West Life Assurance Co., Minneapolis, and *Edward McFaul*, Chicago, personnel and sales management expert.

Dick South Joins Atlas Mineral Products

President *George L. Wirtz* has announced that *Richard South*, formerly an expeditor for the Belden Brick Co., Canton, O., has joined the *Atlas Mineral Products Co.'s* Sales Department and will be assigned to a territory in Southern Ohio, West Virginia and Kentucky on the sale of corrosion resistant materials and related products.

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24" Anodes . . . . . $0.82 each
30" Anodes . . . . . $ .94 each
36" Anodes . . . . . $1.06 each
40" Anodes . . . . . $1.14 each

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Silver Tin Brass
Bags for Standard Elliptic
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30" Anodes . . . . . 72c each
36" Anodes . . . . . 80c each
40" Anodes . . . . . 88c each
Robins' all nylon anode bags made of TOUGH du Pont chemically resistant nylon offer important advantages:
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Coarse or fine-grain abrasives set up right for fast cutting efficiency. Substantial savings are effected through longer over-all wheel life, fewer set-ups and reduced wheel inventory.

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Let our polishing engineer demonstrate Kold-Grip for you, or send for free sample, telling us the metal to be polished, grain sizes to be used, and drying facilities available. We can help you if we hear from you.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • Re Carb • Carbon Preventer • Quenching and Tempering Oils • Brewing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

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COMING EVENTS OF THE A. E. S.

Dayton Branch
Annual Educational Session and Banquet
March 15
Biltmore Hotel — Dayton, Ohio

Los Angeles Branch
Annual Educational Session and Banquet
March 22
Roger Young Hall — Los Angeles, Calif.

Boston Branch
Annual Educational Session and Banquet
April 19
Statler Hotel — Boston, Mass.

Indianapolis Branch
Annual Educational Session and Banquet
April 26
Indianapolis Athletic Club — Indianapolis, Ind.

Edwin F. Lankes Victim of Plane Crash

It is with deepest regret that we report the untimely death of Mr. Edwin F. Lankes, Eastern Regional Supervisor for the Detrex Corp., of Detroit. Mr. Lankes was a passenger on the ill-fated plane that crashed and burned in Elizabeth, N. J. on January 22, 1952.

Hooker to Build New Washington Plant

Plans for a 5 million dollar plant expansion program for *Hooker Electrochemical Co.* was announced by *R. L. Murray*, president. Mr. Murray stated that the company will begin immediately a large construction program for its Tacoma, Wash. plant to increase its chlorine and caustic soda output for the pulp and paper industries of the Northwest.

Hooker has recently arranged for the purchase of a substantial acreage from the Tacoma Port Authority and dredging operations soon to get underway will provide deep water facilities for shipping chlorine and caustic soda by barge. This additional land is being acquired to provide for continued expansion which the company anticipates for the period ahead.

Expansion of Nickel Production Planned

An expansion goal to provide an anticipated 132,000 short tons of nickel from foreign and domestic production in 1954, was announced recently by *Ralph S. Trigg*, Deputy Administrator of the Defense Production Administration for Program and Requirements.

Mr. Trigg said that the goal is not in any sense a limit on production. Because nickel is one of the scarcest of all metals needed in the defense program, efforts are being made to obtain increased production from all possible sources.

The goal of 132,000 short tons annual production represents the amount of nickel that this nation may reasonably expect to obtain in 1954 if presently planned expansion programs are carried out successfully.

It is anticipated that in 1954 the supply of nickel available will be about 31,500 tons more than it was in 1950. The 1950 supply amounted to 100,500 tons, made up as follows: domestic primary production, 900 tons; domes-

tic scrap, 8,000 tons, and imports 91,600 tons.

By 1954 the total supply of nickel available should be about 132,000 tons, made up as follows: domestic primary production, 1,400 tons; domestic scrap, 9,000 tons, and imports, 121,600 tons.

Since the only nickel produced in this country is a small amount obtained as a by-product of copper mining, the increased production will have to come from foreign sources.

Supplies of nickel obtained from Canada are expected to increase from 87,400 tons in 1950 to 106,000 tons in 1954. The Nicaro plant in Cuba, scheduled to come into production this year, is expected to produce about 15,000 tons annually by 1954.

Alert Supply Co. Has New Building

Alert Supply Co. of Los Angeles, manufacturers and distributors of metal finishing products, now occupies a new 10,000 square foot factory and office building in the Los Angeles Central Manufacturing District at 4755 East 49th Street.

The building houses offices, a 28′ x 20′ laboratory equipped for quality control and research, warehouse facilities for plating machinery and supplies, and factory space for blending of buffing compounds.

A new two-ton melting mixer and a 12′ x 4′ x 6′ melting tank have been installed in the new plant to augment several one-ton and half-ton mixers and tanks moved over from the former plant at 6718 McKinley Avenue, Los Angeles.

TRUE BRITE IS FIRST

TRUE BRITE NICKEL BRIGHTENER was the first nickel brightener definitely designed for barrel plating at higher speeds to match still tank bright nickel and provide for good chromium plating on racks or in barrels.

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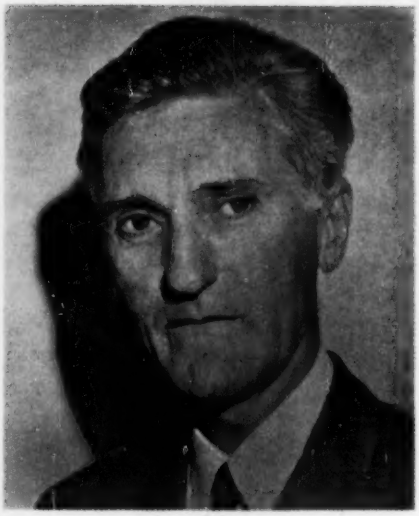

Arthur L. Gaskin

Alert Supply Co. was established in March, 1950, by two former staff members of the *L. H. Butcher Co.* of Los Angeles; *Alfred E. Perkins*, an LHB sales engineer, now president of Alert Supply Co.; and *Arthur Gaskin*, who served as a Butcher Company chemist.

Gaskin, who directs Alert's buffing compound production, previously was associated as a chemist with Bass & Company, in England; the Pennsylvania Salt Co.; H. A. Montgomery Co., Detroit, and Bruce Products Co., Howell, Mich.

In addition to manufacturing abrasives, the firm serves as distributor for Binks Manufacturing Co., Packer Machine Co., H. A. Montgomery Co., Standard Electrical Tool Co., The Carborundum Co., Northwest Chemical Co., Production Machine Co., and Harold L. Palmer Co.

Hooker Adds Research and Engineering Men

The Hooker Electrochemical Co., Niagara Falls, has announced several new appointments in their research and engineering departments.

Abram Davis has been engaged as a research chemist. Mr. Davis is a graduate of Lake Forest College and Illinois Institute of Technology.

Beryl B. McKown is now employed as a technician in the physical laboratory. Miss McKown had previously been associated with *Glenn L. Martin Co.* as a chemist, with *Kraft Cheese Co.* as a laboratory technician, and more recently at Oak Harbor High, Washington, as a science teacher.

Thomas Hooker, a graduate of the University of Rochester and Massachusetts Institute of Technology, is now a member of the chemical engineering group. He previously had been in the employ of *Pfaudler Co.* and *Distillation Products, Inc.*

William F. Harvey, formerly an analytical chemist with *Electrometallurgical Co.*, has been engaged as a mechanical engineer.

Edward J. Kalota has joined the firm as a draftsman.

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Ni—Anodes
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Magnesium Coating Experts Honored

Two metallurgical engineers of *The Glenn L. Martin Co.*, Baltimore, following the announcement last week that a highly successful process resulting from their research teamwork is being made generally available to American industry, have received awards under the Company's incentive program, for their achievement.

Herman Pusin, chief structural engineer, in making the awards to *Paul W. Boone* and *Charles F. Burrows*, of the materials laboratories, characterized their labors toward the development of MHC (Martin Hard Coating) finish for aluminum alloys, as "an outstanding example of objective research in the aircraft field."

The new hard coating, which makes aluminum eligible for the first time in many wear-resistant applications heretofore monopolized by steel alloys, opens a way for industry to take fuller advantage of this lighter metal. The finish, first announced in 1950, has since found so many applications throughout all industry that the Martin Co. has now concluded arrangements with the *Aluminum Company of America* to assist other manufacturers to install facilities for MHC processing.

Paul W. Boone and Charles F. Burrows, of The Glenn L. Martin Co.'s materials laboratory, receive congratulations from Herman Pusin, chief structural engineer, together with awards under Company's incentive program, for their contributions to the development of MHC (Martin Hard Coating) finish for aluminum alloys.

Under this arrangement, further evaluation of the process and exploration of potential applications of the MHC coating will continue, as a laboratory project, but no processing of aluminum parts on a production basis will be handled by Martin—except as may be required in relation to the Company's own products. The commercial development of MHC hard-coating is being undertaken exclusively by the Finishes Div., Aluminum De-

STOP

ACID CARRYOVER INTO RINSE BATHS WITH ACTIVOL!

Acid Carryover into rinse baths not only makes rinsing more difficult, but it means much of your valuable acid is going down the drain. This needless waste can be corrected easily and effectively with ACTIVOL #1321.

ACTIVOL *activates* acids causing them to go to work on oxide scale faster and more efficiently to produce clean, unpitted surfaces. Metals lifted from the bath drain off the acid so completely that carryover is cut to an absolute minimum with acid savings from 10% to 40% possible in most cases. It takes only 0.1% of ACTIVOL on the weight of the acid solution to do the job.

ACTIVOL is effective on all mineral acids including sulphuric, hydrochloric, muriatic, nitric, hydrofluoric, chromic and phosphoric acids for pickling, anodizing, galvanizing, plating, wire drawing, bonderizing, etc.

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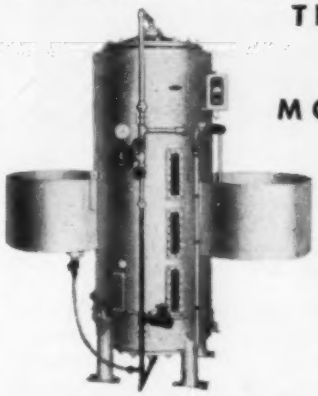
For Plating Solutions & Hot Water Rinses
THE LOW COST*
Penfield
MONO-BED WAY



Operating on the most efficient dionizing technique known (intimately mixed cation and anion resins in a single unit tank), raw water passes through a Penfield Mono-bed Demineralizer only once, *yet comes out with resistances reported as high as 20,000,000 ohms.* No heat or steam power is ever required, and regeneration of resins is accomplished by simple gravity and displacement

*COSTS LESS, OPERATES FOR ONLY PENNIES

Yes, it usually costs less than 15c per 1000 gallons to eliminate unwanted precipitates and hot water rinse stains the Penfield "Planned Purity" way. Write today for new catalog showing Penfield Demineralizers with flow rates from 10 to 10,000 gph.

RUBBER-LINED, SARAN-LINED & NICKEL TANKS
Specially fabricated to suit your individual requirements by Penfield's Tank Fabricating and Lining Division. Write today for complete details.

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FILTERS · SOFTENERS · DEGASIFIERS · DEMINERALIZERS

Penfield "Planned Purity" PAYS!

velopment Laboratory, Aluminum Company of America at New Kensington, Pennsylvania.

Born and raised in Baltimore, Paul Boone was graduated with honors in chemistry, at Gettysburg College, Gettysburg, Pa., in 1931. He studied toward a doctor's degree, 1931-32, at Johns Hopkins Graduate School of Chemistry. Joining the Martin Company in 1933, as a junior chemist, Boone presently heads the Metals Group Materials Laboratory.

Charles Burrows, a native of Cleveland, received a bachelor's degree in metallurgical engineering, in 1937, at the Case Institute of Technology. He earned a aster's degree two years later. Burrows started with Martin as a metallurgist in 1939. He was transferred to the Martin-Nebraska Company in 1941, where he served in the engineering laboratories until after the war. Since 1946, back in Baltimore, he has been continuously identified with the hard coating development.

Protection for Chromium Plate on Automobiles

Frequent washings and occasional applications of a film of light lubricating oil (about S.A.E. 10-W) are all that are necessary to preserve the bright look on chromium plated automobile bumpers, handles and trim parts according to plating experts of the American Electroplaters' Society.

Waxy body-finish compounds also may be used, although these materials are somewhat less effective than oil.

These experts also suggest that clean, dry chromium plated surfaces be wiped over thoroughly with an oil-dampened cloth three or four times during winter months and at least once in summer time. Excess oil may be wiped off with a dry cloth so that luster of bright work is not impaired.

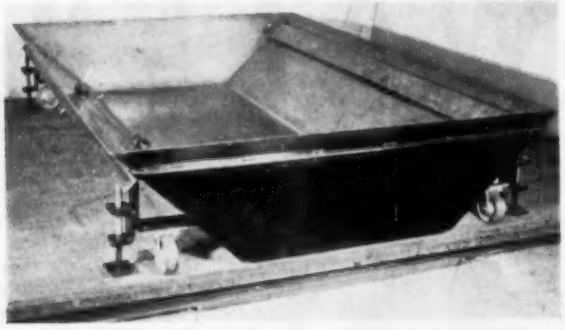
This advice by plating experts is prompted by the severity of recent winter snow falls. More than the usual amounts of salt or calcium chloride have been used on highways and city streets to break up packed-up ice and snow.

If allowed to remain on plated surfaces very long, salt or calcium chloride chemically attacks protective plating. Small holes are opened through the electroplate to expose underlying metal. If the underlying metal is steel, rust will occur. If it is a white metal alloy, white corrosion products spread over the bright surface and spoil its appearance.

When corrosion is already visible on plating, engineers recommend rubbing it with a damp cloth. A mild scouring powder, which would damage neither porcelain nor tile, or an enamel polish, which would not damage automobile finishes, may be helpful.

After rinsing and drying an application of oil will fill the pores in the electroplate and retard further rusting or corrosion.

American Electroplaters' Society engineers point out that because of the defense emergency, which has created a shortage of metals used in plating, some of the present plating on automobiles is thinner than it formerly was and, as a result, in some cases manufacturers are baking on a coat of highly weather-resistant transparent synthetic enamel. Severe scouring may damage or remove this added protection.



This tank goes or stays

IT IS OBVIOUS that the tank can be easily pushed or pulled about — or it can be immobilized by lowering the feet. But these details are not so important as the fact that Stortswelding has made every seam tight and sound, free from porosity and overlaps or other crevices that invite concentration cell corrosion. Our belief that high quality welding results in long life utility is borne out by customer experience with many thousands of Stortswelded tanks.

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Jim Fritts to Head Ternstedt Process Development

Appointment of *James E. Fritts* as director of the process development section of the *Ternstedt Division of* General Motors Corp. has been announced.

Mr. Fritts, formerly engineer in charge of process engineering at the division's Columbus plant, succeeds *Cleveland F. Nixon*. Mr. Nixon's promotion to head of the electro-chemistry department of GM Research Laboratories Division was announced recently.

Mr. Fritts was employed by Ternstedt as a laboratory assistant in 1923. He successively served as general foreman in the plating department and process engineer for plating. He later held various administrative positions in the process engineering laboratory. Mr. Fritts was transferred to the new Columbus plant on Jan. 1, 1946, as engineer in charge of process engineering.

Novak to Represent Industrial Chem. & Equip. Co.

Industrial Chemical & Equipment Co. of Minneapolis, Minn. announces the appointment of *Mr. Albert M. Novak* to their Sales Department. Mr. Novak graduated from the University of Minnesota School of Chemistry in 1935 and was formerly connected with Dearborn Chemical Co. of Chicago. Industrial Chemical & Equipment Co. serves as distributors of metal finishing equipment and supplies to firms in the Upper Midwest; Minnesota, Iowa, Wisconsin, North and South Dakota and Montana. In addition to their sales Department, a complete consulting service is maintained where regular solution analysis as well as thickness tests, etc. are conducted plus extensive salt spray facilities for their customers' use. Mr. Novak will specialize in the sale of metal cleaning and phosphatizing processes and equipment.

Use of Copper Further Restricted for Lamps, Lighting Fixtures

As a measure to conserve copper, the National Production Authority, U. S. Department of Commerce, limited the use of the critically scarce metal in the manufacture of electric lighting fixtures to specific functional parts.

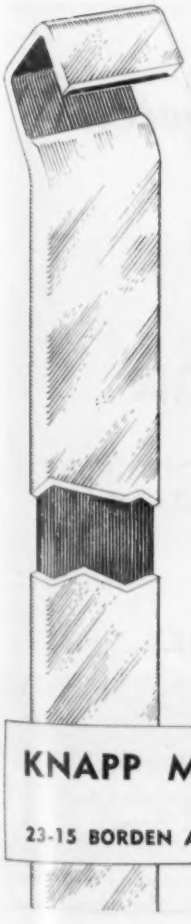
NPA issued Order M-97, effective Feb. 15, 1952, which restricts the use of copper products in four types of lighting fixtures to the following specified parts:

1. Residential lighting fixtures: current-carrying parts and wiring, tubing, plating, rivets, eyelets, screws and small fasteners.

2. Exterior lighting fixtures (except residential): current-carrying parts and wiring, plating, rivets, eyelets, screws, small fasteners, threaded parts, clamping, sealing and attachment devices.

3. Explosion-proof, dust-type or vapor-type lighting fixtures: current-carrying parts and wiring, plating, rivets, eyelets, screws, small fasteners, threaded parts, clamping, sealing and attachment devices.

4. All other lighting fixtures: current-carrying parts and wiring, plating, rivets, eyelets, screws and small fasteners.



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FOR CHROME PLATING

A NEW AND REVOLUTIONARY DEVELOPMENT

Electro-Cupralum Anodes are manufactured by combining copper and lead through a Homogeneous Extrusion Process whereby the two metals are chemically and inseparably bonded together.

The resultant product consists of a full width *continuous* copper electrode with a Homogeneous lead covering on all sides except the underside of the copper hook.

FEATURES

1. **Ten times the electrical conductivity of any Lead Anode.**
2. **Faster, better plating.**
3. **Even distribution of current through solution.**
4. **Permanently rigid.**
5. **Tenacious, insoluble coatings.**
6. **No build-up of temperature.**
7. **Periodic cleaning unnecessary.**

Electro-Cupralum Anodes are *superior* because they combine the *superior* conductivity of copper with the *superior* protection of lead.

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DEPENDABLE SALT SPRAY TESTING EQUIPMENT

Be Sure You Meet Government Specifications

You can test for compliance with critical government plating specifications by using BELKE Salt Spray Equipment. Easy to use — built for long service — economically priced. Tests corrosion resistance of plating, anodizing, galvanizing, paints, synthetic coatings, etc. For information consult a BELKE Service Engineer, or write.

BELKE Salt Spray Bulletin 709 furnished on request.

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EVERYTHING FOR PLATING PLANTS

M-97 does not affect portable lamps and airport, marine, vehicular, aircraft and railroad rolling stock lighting fixtures. Exemptions to the new restrictions are also provided for lighting fixture makers to use up existing copper inventories and materials on order if these materials are unsuitable for other use.

NPA estimated that a quarterly savings of about 3,965,000 pounds of copper products will be made as a result of the new order.

Similar restrictions on the manufacture of lighting fixtures were in effect during April-July 1951 under NPA Order M-12 (Use of Copper and Copper-Base Alloys).

Green Electric Promotes Production Team

The W. Green Electric Co., pioneer manufacturers of selenium rectifier units for electroplating, recently announced the promotion of several key men.

S. W. Berman is now Chief Engineer, *J. Cohen* is Plant Manager, and *J. D. Trehy* has several responsibilities including those of Purchasing Agent, Traffic Manager, and company Secretary. *L. W. Reinken* is now General Manager.

Mr. Trehy has been with Green Electric nearly ten years and his prior experience was with Cadillac, Packard, and Fleetwood Body. Jim Trehy is one of the few men outside of Detroit and Los Angeles, and probably the only one in the rectifier industry, to possess a diploma attesting to proficiency in designing bodies for automobiles and carriages! (Although all larger Green Electric rectifier units are already equipped with roller-bearing caster wheels it is not true that Green are planning on hydraulic brakes for their late 1952 models).

J. Cohen and S. W. Berman joined Green Electric eleven years ago. Mr. Cohen served two hitches in the Army —eight months in 1941, and from August 1944 to February 1946. Mr. Berman served from February 1944 to February 1946. The only time they met during their Army careers was when Sergeant Berman encountered Sergeant Cohen at breakfast in Camp Dix on the day they both concluded their military service. They returned to Green Electric arm-in-arm.

Berman, Cohen, and Trehy comprise the production team which brings to the electroplating industry the well-known line of Green Rectifiers and Crown Model 815. Their many friends in the industry will be pleased at the recognition they have earned.

Shown in the photograph are, on the left—S. W. Berman, on the right—J. D. Trehy. (J. Cohen is inside the unit making a last-minute check on construction.)

Filter your solutions

1,000 TIMES FASTER

ELIMINATES PITTING and ROUGH DEPOSITS

SETHCO FILTER PUMPS do the job faster, more efficiently, more economically.

- Ideal for both continuous and periodic filtration.
- Corrosion proof stainless steel construction.
- No loss of expensive solutions; crystal clear filtration.
- High temp. filter cylinders—transparent lucite or stainless steel.
- Capacity 50-100 gals./hr.; simple operation.

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NO OTHER buff of its type . . .

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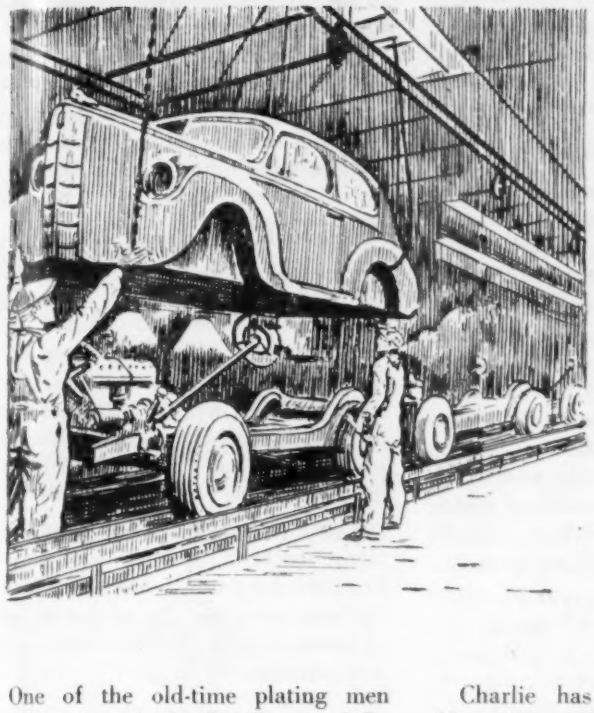

MOTOR CITY PLATING NEWS

by

Edward Finne

One of the old-time plating men in Detroit retired officially as of December 1st, 1951. *Charles Eldridge*, long with United Chromium, Inc., has finally hung up his gloves and is now living the life of Riley(?).

Charlie has worked with United Chromium and its predecessors for 27 years. He can be considered one of the pioneers in the development of chromium plating as we use it now. His early work with Dr. Fink at the old Chile Exploration Co. and at Columbia University gave him the privilege to watch and very materially assist in the growth of chromium plating from a laboratory curiosity to a great segment of the whole plating industry.

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In later years, Charlie has been working out of the United Chromium Detroit office as sales and technical engineer on the company's processes and coatings.

So passes from the active plating scene a man that rates the very highest in this writer's affection and esteem. I know that I will miss his periodic business visits, and many others in the industry will too.

The best wishes of all his friends go out to Charlie in his retirement—may he become extra fluent in his Spanish.

****

Phil Huber, chairman of the board of the *Ex-Cello-O Corp.*, died February 7th at his home. Born in Germany, he came to this country when he was 12 years old. He had lived in Detroit for 40 years and was 62 when he died.

In addition to being one of the founders of the Ex-Cell-O Corp. he was the president of the *Michigan Chrome & Chemical Co.*, job platers and manufacturers of rack coatings, stop-off materials and chemical specialties, and a director of the Industrial National Bank and the *Mid-west Abrasive Co.*

Mr. Huber is survived by his wife and two sons, one of whom, *Bob Huber*, is directing the activities of the Michigan Chrome & Chemical Co., and who is well known in the job plating field both locally and nationally.

****

The *Wagner Brothers* did it again. They have added a wing to their present plant, offices and laboratories at 400 Midland Ave., Detroit. To celebrate the completion of the new structure, they threw one of their famous parties to which were invited their many friends—so many that the affair had to be staged in two shifts. Thursday and Friday, the 31st of January and the 1st of February, saw a majority of the platers and those closely connected with the industry at the "Wagner Brothers Building Bust."

In contrast to the previous celebration, this one showed the results of a lot of serious thinking as pertains to an efficient system. Invitation was by card only and the partygoer had to pass through a couple of Pinkerton guards who verified his invitation against their own guest list. All of which leads us to think that the annual party sponsored by the Detroit Branch of the AES could profit by the system used by the Wagner boys.

Aside from this, the invited parties did enjoy free drinks, good food, entertainment, and the pelasure of mingling with his cohorts in this sometimes maddening whirl of metal finishing.

****

Electroplating, Inc., 22126 Ryan Road, Van Dyke, Mich. is one of the newest job plating plants to open its doors for business in the Detroit area. The brand new plant comprising 1,600 square feet of working area is equipped for copper, nickel and chromium plating on a decorative basis; grey nickel for ordnance work, and hard chromium plating.

Charles Tackels is operating the plant. Tackels formerly was Service Engineer for the *Udylite Corp.* in the Mid-west area and he brings 6 years of plating experience with him on his new venture.

****

Peninsular Chemical Products Co., 6795 East Nine Mile Rd., Van Dyke, Mich., has recently added an 8,000 square foot building to their existing plant. This new addition will eventu-

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ally house a completely revamped plating and polishing room to service their customers in cadmium, zinc, copper, and hard chrome plating. In addition, the firm specializes in flash chrome plating of stainless steel.

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Charley Forrester, long time plater, is masterminding the plant's operations.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Rockford Branch Annual Banquet and Technical Session

In the February issue of METAL FINISHING it was erroneously reported that the Tenth Annual Banquet and Technical Session of the Rockford Branch would be held on April 26th. The correct date is April 19th.

Los Angeles Branch

When it became known that *Joseph Gurski*, head of the materials and process section of the manufacturing research department of the *Ford Motor Co.*, Dearborn, Mich., would be in Southern California in mid-February, it was a "natural" for *Earl Arnold*, Librarian of The Los Angeles Branch, himself a former Detroit plating specialist—to invite Mr. Gurski to address the branch.

Mr. Gurski has been employed by Ford Motor Co. since 1934 as a chemical engineer. In his present post he is, in some measure, responsible for specifications on plated parts, and engages as well in trouble-shooting and research. He is secretary-treasurer of The Detroit Branch and also active in ASTM and ASE committee work.

Mr. Gurski addressed the February 13 meeting at the Rodger Young Auditorium on the subject of "*Plating Applications to Automotive Parts.*" He presented the greater portion of his talk in the form of explanatory comment of various slides and graphs which were projected on the screen.

Preliminarily, he explained that four individuals largely are responsible for the success of plated automotive parts: The materials engineer, who specifies the base material; the buyer of the material; the plater who applies the deposit; and the quality control engineer. Mr. Gurski confined himself primarily to the roles played by the materials engineer and the quality control man.

Mr. Gurski's discussion on selection of coatings dealt with specifications, substitute finishes, methods of testing, and factors affecting quality. He then touched upon such phases as resistance to corrosion and wear, reduction of scoring and galling, carbonizing or nitriding tendencies in stop-off, brazing, soldering, electroforming, adhesion of rubber to steel, and identification of coatings.

"As far as reducing deposit thickness to meet the shortness of material is concerned," Mr. Gurski said, "I think we have already gone as far as we can in that respect, perhaps too

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far. Substitute finishes for bright work are being used to some extent now, such as baked enamel."

A Question-and-Answer period was conducted by Librarian Arnold and the speaker at the conclusion of the talk.

President *Ray Lostutter* presided over the business session. The first order of business was appointment of a nominating committee to screen candidates for branch officers. The committee was instructed to preesnt a slate for vote of the membership at the March 12 meeting.

If precedent is following by nominating the incumbent first vice-president unopposed for the presidency, the branch will be fortunate in being headed in 1952 by another man of proven leadership and executive ability —*Myron Orbaugh*, of the *Bone Engineering Co.* As first vice-president and attendance chairman in 1951, Myron developed the monthly meeting attendance to a new high average. In this effort the was given material aid by Secretary *G. Stuart Krentel*, whose forcefully phrased meeting announcements appeared to have exceptional power in drawing members to the meetings.

Guests introduced at the February session included *Ted Goodman* and *Bernie Lupescu*, of Santa Monica Plating Co.; *Ray Taylor* and *Charles Malotte*, of General Electric Co., Ontario, Calif.; *W. A. Peters*, Braun Corporation; *Edward Cox*, S&M Lamp Co.; *Walter Cole*, Turco Products Co.; and *Frank Lammens*, Travis Plating Co., Venice.

Cannon Electrical Development Co. invited AES members to attend an open house celebration at the firm's Los Angeles offices and plant on February 16 and 17.

Annual Meeting

The annual educational session and dinner dance of Los Angeles Branch of the AES will be held March 22 at the Rodger Young Auditorium, Los Angeles.

General Chairman *John Millhorn*, of the Mefford Chemical Co., is gearing arrangements to an anticipated attendance of 150 at the day-time technical sessions and 500 at the dinner and dance in the evening.

The program calls for an educational session from 9:30 a.m. to noon, luncheon from 12:30 to 2 p.m., and an afternoon technical session from 2 to 4 o'clock.

Librarian *Earl Arnold*, of the L. H. Butcher Co.'s laboratory staff, has arranged for three notable speakers from the mid-west and east and one from the Far West. The speakers and their subjects are:

Dr. M. M. Beckwith, Harshaw Chemical Co., "*Fluoborates in Plating.*" *Dr. Donald Price*, Oakite, Inc., "*Cleaning in Plating.*" *Dr. Henry Brown*, Udylite Corp., "*Corrosion Resistance of Plated Coatings.*" The program will be rounded out with a West Coast speaker on a still undetermined subject.

A story-telling contect — which proved popular in previous years— will feature the noon-day luncheon. A prize is to be awarded to the one telling the best story, based on skill in narration, degree of humor and volume of laughter that is generated. A floor show, waltz contest and dancing are included in the evening's entertainment program, plus the distribution of a large number of spendid door prizes which Millhorn's committee has rounded up.

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Cincinnati Branch

Another fine turnout was on hand for the meeting of the Cincinnati Branch of the A.E.S. on January 23, with President *Robert D. Miller* opening the proceedings with a discussion of the meeting at Philadelphia on February 9th. Since none of the members would be able to attend this meeting the Secretary was instructed to send a letter to the Executive Committee, Executive Secretary, and all Branch Secretaries informing them of the inability of any Cincinnati members attending due to the high cost involved, the possibility of conducting regional meetings at lower cost, and the fact that considerable unjust criticism had been levelled at the plating industry for its inability to provide finishes of a pre-Korean war type on consumer products. In line with the latter point it was suggested that a promotional campaign be conducted to explain the hardships under which the plating industry is operating.

The Secretary read resignations received from *Carl C. Claybaugh*, as Vice-President and *George Kahan* as member of the Cincinnati Branch. Both resignations were accepted since both members had left the city. The applications of *Frank Bonem* and *Joseph Ryan* were presented to the membership, and both candidates were unanimously elected.

The Picnic Committee advised that it hoped to have a report for the Branch at its February meeting.

After introducing six guests, President Miller explained that the speaker, *H. L. Head*, Detroit, was unable to attend due to illnes and press of business. In his place, they were fortunate in securing *Mr. John E. Kinney*, Sanitary Engineer, Ohio River Valley Sanitation Commission (Committee Coordinator) who took as his subject "*Industrial Water Treatment and Pollution Abatement.*" Mr. Kinney explained the functions of the Ohio River Valley Sanitation Commission, and then pointed out the misfortune that the more the industry, the more the pollution. However, he stated that with proper treatment, polluted waters can be used again and again, and that much is being done to improve bad conditions. Noting that the Commission's work is being accomplished by "impelling" rather than "compelling," Mr. Kinney felt that many valuable materials could be saved from waste, particularly by small shops and that their waste can be just as harmful as from the large production plants. The load of chemicals lost, he said, can be reduced by proper treatment, even for small companies. Concluding with the pertinent thought that the prime reason for prevention of pollution is water conservation, Mr. Kinney cautioned his audience to measure their waste loads, reduce them, then treat!

The *Udylite Co.*, Detroit, then acted as hosts for the customary Social Hour.

Pittsburgh Branch

The Pittsburgh Branch of the A.E.S. held its regular monthly meeting at the Sheraton Hotel on January 10, 1952. Unfortunately, icy roads and hazardous driving conditions prevented a great number of members from attending. Approximately twenty

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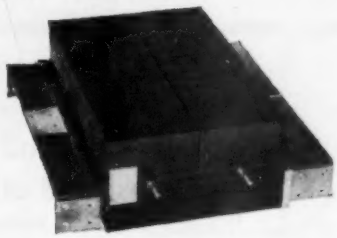

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(20) members were able to reach the Sheraton in spite of inclement weather.

The business meeting was dispensed with, since several important matters were to be discussed and it was felt that we should wait until more members were able to attend. *Mr. Clyde Cupps*, of Standard Steel Spring Co. delivered a fine paper titled "*Practical Waste Disposal.*" The lengthy discussion period which followed Mr. Cupps' talk was indicative of the quality of the presented subject. Everyone present felt that this was one of the most interesting and timely subjects that has been discussed in the present year.

Indianapolis Branch Annual Session and Banquet

The Annual Banquet and Technical Session of the Indianapolis Branch of the A.E.S. will, be held on Saturday, April 26, at the Indianapolis Athletic Club. A program of interesting and informative technical papers has been planned, and the evening's program will include a fine dinner, entertainment, and dancing.

Chicago Branch

On January 11th the Chicago Branch had an Educational Session on "*Conversion Coatings for Metal Surfaces.*" It was ably presented by *Mr. Hubert Goldman*, of the Enthone Co. The program chairman was very pleasantly surprised by the large turn out. Apparently military requirements and substitute finishes for bright nickel have made conversion coatings of great economic interest to platers. Mr. Goldman also described two new developments which created great interest. These were an immersion non-electrolytic "anodizing" process and an alkaline cathodic pickle for cast iron and steel. Both processes are very promising and we look forward to their extensive exploitation by the plating industry.

New York Branch

The meeting was called to order by *Mr. George Herrmann*, President, on Friday, January 11th, 1952 at the Hotel Statler, New York.

Applications were received from the following men: *Mr. Fred Balsamo, Mr. Leonard Cuthie, Mr. Louis Serota, Mr. Joseph J. Briganti, Mr. Salvatore J. Briganti, Mr. Masiano Briganti.*

The following were elected to membership in the New York Branch and duly installed: *Mr. Nicholas J. Sandalena, Mr. Rubin M. Operowsky, Mr. Joseph S. Schneidt, Mr. Charles Sivelle, Miss Pauline Goldman.*

An announcement was made by *Mr. Schore* of the starting of a new electroplating course at Brooklyn Technical High School.

Mr. Angelo Amatore, first Vice-President of the New York Branch, was made chairman of a committee to organize a branch exhibit for the Metal Finishing Exposition.

Mr. Frank MacStoker and *Dr. George Swift*, the first and second National Vice-Presidents respectively, explained the purpose of the coming meeting in Philadelphia for the branch membership. They stressed the fact that the branch representatives going to this meeting could not transact any final business there but should make it their duty to get a full report from all of the committees including the Magazine Committee, the Research Committee, as well as the Membership and Finance Committees. Furthermore,

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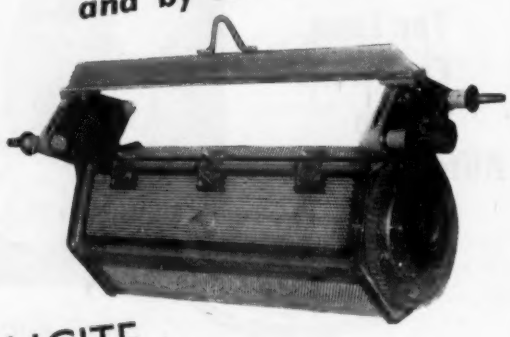

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this meeting is to "iron out any gripes" which the various branches might have. As a result of the explanations, it was decided to send the New York delegation uninstructed.

Mr. Wm. Schneider, on behalf of the Executive Board, recommended *Mr. Wm. Foss* to honorary Branch membership.

Following the business meeting, *Mr. Sidney Lewis,* of the U. S. Stoneware Corp., gave a very interesting and practical talk on the various tanks and tank linings which are available today.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Starr Thayer, Earl Gulbransen to Receive 1952 NACE Awards

Starr Thayer, a cathodic protection consultant of Houston, Texas, and *Earl A. Gulbransen,* advisory engineer to Westinghouse Research Laboratories. East Pittsburgh, Pa. were designated to receive the 1952 annual Frank Newman Speller and Willis Rodney Whitney Awards from the National Association of Corrosion Engineers. The awards were presented at the annual banquet of the association on Thursday, March 13 during the Eighth Annual Conference and Exhibition at Galveston, Texas. The Speller award is given for achievement in corrosion engineering. The Whitney award is for achievement in corrosion science.

Mr. Thayer, among the first engineers to apply cathdic protection to underground structures is a 1908 graduate in electric engineering of Iowa State College. Since 1931 he has installed many cathodic protection systems in this country and abroad.

Mr. Gulbransen, whose principal scientific interests are in the high temperature field, joined Westinghouse Research Laboratories in 1940. A 1931 graduate of State College of Washington, in chemical engineering, he obtained a Ph.D. in physical chemistry from University of Pittsburgh. Author of many papers, he was consultant during the last war to the government on new methods of underwater propulsion. He has been a teacher of chemistry and chemical engineering, is a member of several technical societies and has been honored many times by selection as chairman of national meetings of scientific groups.

News from California

By Fred A. Herr

Southern California plating shop operators, many of whom deionize the water supplied by the Los Angeles Metropolitan Water District for use in their plating plants, are keenly interested in the ultimate outcome of an experiment now under way for de-salting sea water, which, the sponsors claim, should produce distilled water at a cost almost comparable to the present industrial water rates.

The process to be tested is the brainchild of *Peter Jones,* a Los Angeles refrigeration consultant. His plan of de-salting sea water involves boiling it with a vacuum rather than by the more expensive use of fire. The technique is based on the well-known principle that water boils at much lower temperature on a mountaintop than at sea level. Jones contends that by in-

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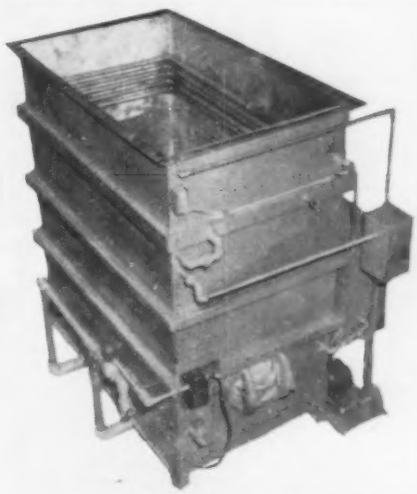

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troducing a partial vacuum in apparatus placed close to the shore, the cost of heat would be eliminated from the distillation process.

Erection of a $50,000 pilot plant to test the Jones plan was started around February 1. The contract calls for completion of the pilot plant within ten months. It will be mounted on a trailer.

Jones estimated the pilot plant should be able to freshen water at the rate of 150 gallons an hour, and that $100,000,000 to $200,000,000 would be needed to build the 100 large plants necessary to supply the city of Los Angeles with the 350,000,000 gallons of water now required daily.

Engineering blueprints of the apparatus disclose it to contain a circulation system in which clogging is prevented by a continuous discharge of impurities back to the sea.

One of the obstacles impeding the efficient operation of the plan was recently eliminated, Jones reported. This impediment derived from the fact that when copper tubing is wet both inside and out, as is the case in this apparatus, a serious obstacle to heat transference is set up. This drawback has been overcome by some new forms of carbon compounds which, applied as coatings to the tubes, keep their surfaces dry when they are submerged.

A cheaper source of pure water is, of course, of interest to every plater in Southern California. Most shops are at some time or other plaqued with impurities in the water supply, which ultimately contaminates plating solutions. The Los Angeles Branch of the A.E.S. regards the subject of water-in-the-plating shop of sufficient importance to schedule at least one educational session a year to a discussion of deionization.

Manville D. Smith, managing director, *Industriel Sono-Radio*, S. A., Lima, Peru, a recent visitor to Los Angeles, reported the installation of a 10-position plating room in his record processing plant in Lima. The division is equipped to produce ten record stampings per day. Smith spent two weeks in Los Angeles studying record pressing and plating technique at Coast Import Company's Los Angeles plant.

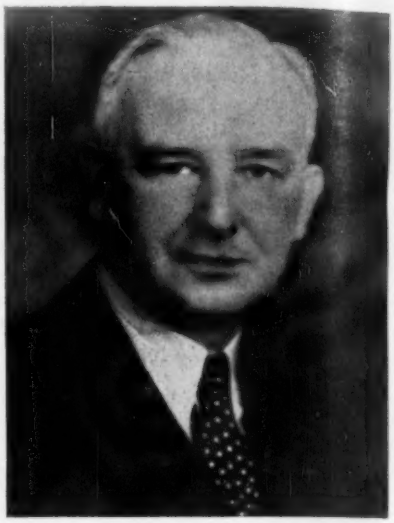
A plating department of similar capacity has also been installed by *Agencia Philco*, S. A., in Lima, Peru, of which *Carlos Don Vich* is general manager.

E. T. Brown, of Los Angeles, president of the *Metal Finishing Association of Southern California*, in January attended a meeting in Washington, D. C., of the NPA Industry Advisory Committee for the plating industry.

A new anodizing operation, headed by *I. L. Lanphere*, has been organized at Burbank, Calif., under the firm name of *Valley Anodizing Corp.* A plant equipped to specialize in plating machinery has been opened at 2504 Ontario Avenue, Burbank.

OBITUARY

HORACE H. SMITH



It is with deepest regret that we report the death, on February 21st, of Horace H. Smith at the Presbyterian Hospital, Newark, N. J. Born in Bloomfield, N. J., he was 67 years of age. Horace had been in poor health for the past several years following a serious operation.

Horace was one of the best known men in national plating circles, having

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been president of the Supreme Society in 1929 and 1930. In 1947 he was made an Honorary Member of the A.E.S. He was also a Charter Member and prime mover of the Newark Branch, and was always very active in its affairs, including being General Chairman for the Atlantic City convention of the Society in 1948.

Up until a year ago he was still active in the plating field with the Surety Plating Co., of Newark. His poor health forced him to retire at that time. A week before his death he had attended the N. Y. Branch Annual Banquet.

He is survived by his widow, Catherine, and two brothers, to whom we offer ours and the plating industry's deepest sympathy.

TECHNICAL LITERATURE

1951 Supplement to A.S.T.M. Standards

Published by the American Society for Testing Materials, 1916 Race St., Phila 3, Pa.

This latest revision of the bound volumes of A.S.T.M. Standards (1949 issue) contains a number of changes in the standards for *Electrodeposited Metallic Coatings*. These latest revisions are given below:

1 — A.S.T.M. Tentative Specification B142-45T *Nickel-Chrome Coatings on Zinc Alloys* now becomes a permanent Standard, with the new designation B142-51. No changes in the specification proper were made.

2 — A.S.T.M. Tentative Specification B164-49T *Zinc Coatings on Steel* becomes B164-51T. The revisions affect methods for checking the thickness of plating on threaded parts, stating that the nearest adjacent smooth area be used for the measurement. It also adds notes on the interpretation of salt spray results, and cautions users against complete dependence on salt spray tests in evaluating different coatings.

3 — A.S.T.M. B165-49T, *Cadmium Coatings on Steel*, now becomes B165-51T, with the same remarks applying as above for Zinc coatings.

4 — A.S.T.M. Tentative Specification A 219-49T, *Testing Local Thickness of Electrodeposited Coatings*, now becomes A219-51T, with the following revisions: Some changes in the notes on Magnetic Methods for Testing Deposit Thickness were made. Accuracy of the method must be insured by calibrating the instrument to ± 5% for single coatings and ± 15% for composite coatings.

Calibration for specially shaped pieces must be made to insure the above accuracy. This can be done by plating this shaped part and measuring the thickness microscopically, then calibrating the magnetic instrument.

5 — A.S.T.M. Tentative Specification B242-49T, *Preparation of High-Carbon Steel for Plating*, now becomes a permanent Standard, with new designation B242-51. No revisions in the standard proper weer made.

6 — A.S.T.M. Tentative Standard B252-51T, *Recommended Practice for Preparation for Plating of Zinc Base Die Castings*,

7 — A.S.T.M. Tentative Standard B253-51T, *Recommended Practice for Preparation of Aluminum Alloys for Plating*,

8 — A.S.T.M. Tentative Standard B254-51T, *Recommended Practice for Preparation of Stainless Steel for Plating*, are all new Tentative Standards published for the first time officially.

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